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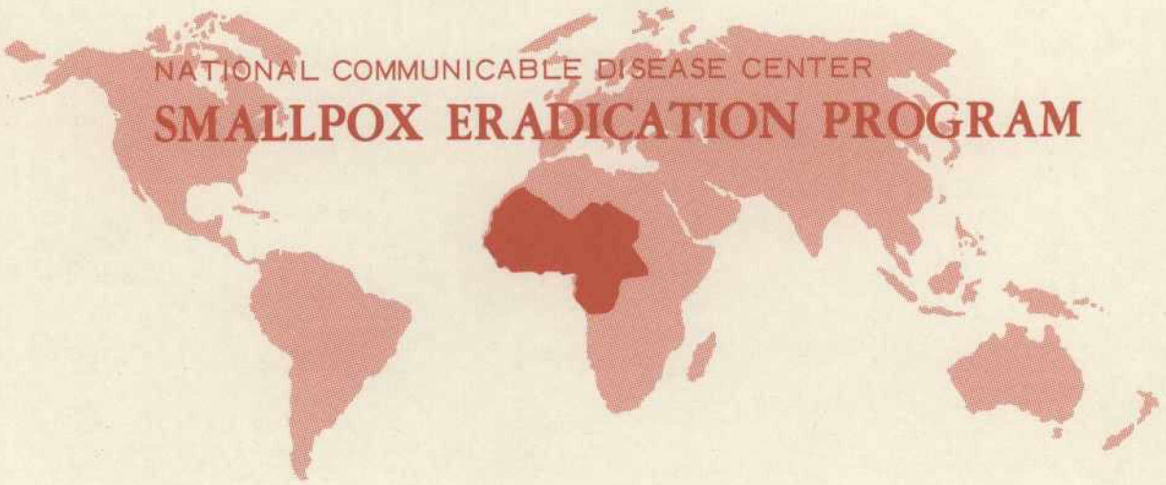

NATIONAL COMMUNICABLE DISEASE CENTER

SMALLPOX ERADICATION PROGRAM

THE SEP REPORT

SEMINAR ON SMALLPOX ERADICATION AND MEASLES CONTROL IN WESTERN AND CENTRAL AFRICA

Proceedings of a meeting held in Lagos, Nigeria, May 13-20, 1969 — Part I

Jointly sponsored by the: World Health Organization, the U.S. Agency for International Development, and the National Communicable Disease Center

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

PUBLIC HEALTH SERVICE

DR. G. A. ADEMOLA
PRINCIPAL MEDICAL OFFICER
MINISTRY OF HEALTH
LAGOS, NIGERIA
1920-1969

The proceedings of this Seminar, to which he contributed so much, are dedicated to the memory of Dr. G. A. Ademola in gratitude for his leadership in smallpox eradication and measles control in Africa.

Dr. Ademola's death is a profound loss to his family, his many friends, and to his country which is healthier because he lived. The real tribute to his life is a memorial of uncounted living who survive him as the direct result of his continuing unselfish efforts to eliminate needless death and preventable illness.

Dr. Ademola received his medical degree from Durham University, a Diploma of Public Health degree from London University and a Master of Public Health degree from Harvard University. He was instrumental in providing the early interest in a smallpox eradication program for West and Central Africa and remained intimately involved in planning, organizing and carrying out the program in Nigeria. He was extremely gratified by the results of smallpox eradication and measles control, and in characteristic fashion was using his boundless energy to expand the program with additional assaults on the burden of disease shared by his countrymen; a burden which caused him much personal anguish.

Whether working for national health programs, giving of his time in clinics and hospitals during vacations, or aiding the victims of war, Dr. Ademola exemplified the full potential of a public servant. He remains an inspiration to those who knew him and a standard to emulate for those who would serve the health needs of Tropical Africa.

11 July 1969

PREFACE

In May 1969, a Seminar on Smallpox Eradication and Measles Control was convened in Lagos, Nigeria, under the joint sponsorship of the World Health Organization and the United States Agency for International Development (USAID). The Government of Nigeria served as host.

At the time of the Conference, most of the countries of Western and Central Africa were concluding the intensive systematic vaccination phase of programmes which had begun in January 1967 as a coordinated regional effort with support from United States bilateral assistance and WHO. Over 80 million of the 120 million inhabitants had been vaccinated against smallpox and more than 15 million children had been vaccinated against measles. Smallpox cases were being reported by only four countries and, in these, the cases were few and the number was diminishing rapidly. Measles incidence had also declined sharply in many areas. The Seminar provided an opportunity to exchange experiences regarding the execution and development of the programme, to examine critically its strengths and weaknesses, and to determine the future course of the programme in order to make further progress.

Participating in the Conference were 27 representatives and consultants from 17 Western and Central African countries; 49 technical advisers (USAID) from the National Communicable Disease Center staff, including those assigned to West and Central African countries, those from the Regional Office in Lagos, as well as the headquarters office in Atlanta, Georgia, USA; World Health Organization staff and consultants; and others from the Red Cross, UNICEF, and USAID.

Papers presented at the Conference, appropriately edited for brevity and clarity, are included in this document.

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Dr. G. A. Ademola, Nigeria
Dr. Cheick Sow, OCCGE
Dr. René Labusquière, OCEAC

SECRETARIES: Dr. D. A. Henderson, WHO
Dr. J. Donald Millar, NCDC/AID
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TABLE OF CONTENTS
(Part I)

OPENING OF THE CONFERENCE

Dr. the Honourable J. E. Adetoro[1]

It gives me great personal delight and gratification to welcome the delegates to this Seminar on Smallpox Eradication. That personal pleasure is derived partly from the fact that the twin campaign to eradicate smallpox and to control measles was officially launched a few weeks after my appointment as Federal Commissioner for Health. I have therefore followed every stage of its progress, and I am happy to note the great success which it has achieved in just over two years. It is a programme which has brought together an impressive array of talents gathered from the 20 countries that comprise the West African Region. This battery of talent has been so effectively utilized that we can now say that we are on the very threshold of complete eradication of smallpox in West Africa. I heartily congratulate each of you, the organizations and the Governments that have provided the financial, moral, and personal backing for such an outstanding achievement in such a short time.

To reflect back, it was only three years ago, at the 19th World Health Assembly, that the World Health Organization embarked upon a world-wide programme with the object of wiping out this old and much dreaded scourge of smallpox from the face of the earth. In these three years, so much has been achieved that we can all point with pride that smallpox is now confined to a few well defined geographic areas and that through the continuation of the aggressive measures which have been launched, we are confident of achieving the final goal of worldwide eradication by the year 1977. Here in the West Africa Region, the programme which began in the first half of 1967 has snowballed in extent and complexity, and today we have recorded a total of 80 million smallpox vaccinations. Last month smallpox was reported in only four of the 20 participating West African countries. All countries have completed, or will have completed by the end of this year, the massive attack phase of the programme and we anticipate that these countries will be smallpox-free by the beginning of 1970. It is indeed an outstanding achievement.

As I have already noted, briefly, this effort is a gigantic international, intergovernmental and inter-agency operation. We cannot over-stress the important roles played by the World Health Organization, particularly the Regional Office for Africa and the United States Agency for International Development. These two agencies have supported the planning and execution of the programme within the regional concept of attack and maintenance. This is in itself a logical arrangement within the global strategy against the disease, for all appreciate the fact that diseases recognize no political frontiers and have to be attacked on an integrated basis if we are not always to have with us the danger of reintroduction and crosstransmission.

With regard to the Nigerian sector of the programme, I am extremely pleased and proud to report that despite the tragic civil disturbances in which we have been engaged, there has been this year no major epidemic of smallpox. This achievement has been due largely to the efforts of over 50 vaccination teams which have been mobilized and deployed to meet the requirements of 60 million people in this country. The logistics of this programme are not easy. The geographic, social, economic, and transport problems concerned in the movement of teams through the creeks and tributaries of the Delta and coastal areas and throughout the huge sprawling areas in the geographic north have taxed our resources to the maximum. Air, road, water, and horse transporation has been used wherever necessary. These combined efforts have enabled us to vaccinate an average of 2.5 million Nigerians every month, and, as of this date, more than 36

[1]Federal Commissioner for Health, Nigeria.

million people have been vaccinated by our roving teams. The logistics of this vast operation have added a most useful stock of experience which will no doubt be of immense value when the time comes to organize a similar assault on such other dreadful diseases as poliomyelitis, tuberculosis, tetanus, and whooping cough. Moreover, our success in this programme has given cause for confidence that similar campaigns in other parts of the world, particularly in South East Asia, South America, and East Africa can meet with similar success.

Although we have broken the backbone of smallpox in our West African Region, the task is by no means over and that is why we are gathered here this week to evaluate our methods, techniques, and to review critically our achievements and any shortcomings that may have revealed themselves during the last couple of years. As in the past, the Government and People of Nigeria continue to welcome all international gatherings, seminars, and conferences. Crisis or no crisis, we are all determined to continue to play our part in the activities that bring nations of the world together. We Nigerians appreciate the fact that while internally, we must stand together to succeed, it is equally important that a nation cannot constitute itself as an island complete and separate from the rest of the world. Therefore, we think it necessary to participate in every activity through which our common identity of interest and problems can be emphasized.

I wish you success in your deliberations.

I N T R O D U C T I O N

THE GLOBAL STATUS OF SMALLPOX ERADICATION - D. A. HENDERSON

DEVELOPMENT AND STATUS OF THE SMALLPOX ERADICATION AND MEASLES CONTROL PROGRAMME IN WEST AFRICA - J. D. MILLAR

THE GLOBAL STATUS OF SMALLPOX ERADICATION

D. A. Henderson[1]

The achievement of this region in altering its status from one of the most highly endemic in the world to a virtually smallpox-free state in a period of less than three years, has been an inspiration to countries throughout the world. The fact that virtually every sort of difficulty experienced by programmes elsewhere has been encountered and satisfactorily dealt with has provided a fund of experiences and techniques applicable in many parts of the world.

While programmes in western and central Africa have been proceeding at an unprecedented pace, programmes in other parts of the world have also been gaining momentum. It is well, I believe, to take a few minutes at the beginning of this Seminar to view the developments in the smallpox eradication programme from a global vantage point.

As you know, the global programme commenced in January 1967, and is now in its third year. During the first year, reported cases actually increased from 89,000 to over 123,000. (Figure 1) In part, this may be attributed to better reporting but, in part, longer term cyclical trends may have been responsible. During 1968, despite increasingly improved reporting, the incidence decreased by 40% and, in 1969, a further decline of almost 45% has been observed to date. Based on present trends, it is estimated that about 45,000 cases will be recorded during 1969.

Figures 2 and 3 depict smallpox rates by country in 1968 and 1969 (projected estimate). These show a reduction in the number of countries recording 5.0 or more cases per 100,000 population. In 1968, 10 countries recorded rates in excess of 5.0 per 100,000; 13 countries recorded such rates in 1967; and, in 1966, 15 countries recorded rates of this magnitude or greater. Based on present trends, it is likely that only two countries, Indonesia and the Democratic Republic of the Congo, will record rates of 5.0 per 100,000 or greater during 1969.

South America (Figure 4)

In the Americas in 1969, cases have been recorded only in Brazil, the sole endemic country in this Region. The eradication programme has been intensified in Brazil during the past year. The number vaccinated in the systematic vaccination campaign is approaching 2 million per month; almost 35 million have been vaccinated since the programme began. Smallpox incidence began declining approximately a year ago and, to date in 1969, 861 cases have been recorded, a decrease of 30% from the number recorded last year at this time. Neighboring countries have also intensified vaccination and surveillance activities.

Africa, West and Central (Figure 5)

As the progress of smallpox eradication in western and central Africa will be discussed subsequently in detail, I shall note only that the curve depicting incidence by month is by far the most dramatic of those for any endemic region. This is even more remarkable when it is recognized that since the intensified programme of surveillance began in October 1968, reporting has been much more complete in your countries than in most others. It is also worth mentioning that of the 10 countries with the highest rates of smallpox in the world in 1968, 5 were in this area.

[1]Chief, Smallpox Eradication Unit, World Health Organization, Geneva

Africa, East and South (Figure 6)

During 1969, recorded cases of smallpox in east and southern Africa declined more than 50% from the number reported in 1968 during the same period of time. Smallpox incidence is presently at a record low level. No cases have been reported to date in Rwanda, Swaziland or Zambia and only three countries, the Democratic Republic of the Congo, Ethiopia and Sudan, have reported more than 100 cases in this year.

In the Democratic Republic of the Congo, 635 cases have been recorded in 1969 compared to 1,602 cases at this time last year. In this country of 16.7 million persons, vaccination activities have been sharply increased during the past two years as indicated below:

	No. of Vaccinations		
	Eradication Programme	Other Health Services	Total
1967	302,000		302,000
1968	2,275,000	574,000	2,849,000
1969 (5 months only)	1,701,000	1,618,000	3,319,000

Since the beginning of 1969, special efforts have been made to improve the completeness of routine case notification and plans are being developed to undertake intensified investigation and containment activities later in the year. A successful programme in the Congo is particularly important as this country occupies a strategic position in Africa, having common borders with nine other countries.

In 1969 to date, Ethiopia and Sudan have together recorded a total of 272 cases, an increase of 25% over the number of cases recorded at this time last year. In the Sudan, smallpox outbreaks commenced in mid-December in the southern part of the country and continued into May. A total of 121 cases were detected in 34 towns and 4 provinces. Investigations did not begin until several months after the outbreaks began and the original source of infection could not be determined. The outbreaks coincided with a very large seasonal migration of agricultural workers into east central Sudan from the southern part of the country and from Ethiopia. Over 900,000 vaccinations were performed in an effort to contain the outbreak, which has now receded, as in previous years, with the onset of rains and the return of the agricultural workers to their homes in southern Sudan and Ethiopia. It is possible, however, that residual foci of smallpox may persist in this area. In the meantime, an eradication programme has commenced in Sudan. At present, activities are principally concentrated in the central part of the country.

Little information is available regarding smallpox activities in Ethiopia. No formal programme of control or eradication is planned. Reporting is recognized to be very incomplete and it is reasonable to assume that the actual incidence of disease is many times that which is presently recorded.

Asia (Figure 7)

Smallpox incidence in Asia declined by 40% in 1968 and appears to be declining at a comparable rate in 1969. However, from one country to the next, progress in the smallpox programmes differs widely as do the trends in incidence and factors influencing these trends.

A very intensive programme is underway in Indonesia. The programme commenced in July 1968 and has progressively been extended throughout the country. Paradoxically, in 1969, the reported incidence of smallpox to date is little different from that in 1968. Reporting, however, has been greatly intensified and containment teams, initiated in January of this year, have steadily broadened their extent of activity. The impact of the vaccination programme in reducing reported incidence has thus been nullified by the improvement in notification. Comparatively few foci of smallpox are present outside of the island of Java, on which reside 65% of the population and on Sumatra. East Java with a population of 26 million has had no smallpox with the exception of a few importations, and these have been rapidly controlled. Intensive containment operations in parallel with the systematic vaccination programme have strongly curtailed smallpox in Central Java.

Increased notifications were received during 1968 from both Afghanistan and Nepal, and a further increase in 1969 from Nepal. In both countries, eradication programmes are steadily being intensified and more complete reporting is apparent.

A marked decline in smallpox occurred this year in East Pakistan which, in 1968, recorded its highest incidence in a decade. Although an eradication programme has begun, the fall in incidence must be attributed in part to the expected cyclical variation. The opposite pattern occurred in West Pakistan which is one of the few reporting areas which has recorded an increase in smallpox in 1969. An eradication programme in West Pakistan is just beginning; surveillance activities have not yet been organized.

In India, an increased emphasis has been placed on vaccination of those never previously vaccinated, particularly pre-school children; the use of liquid vaccine has been totally abolished; vaccine storage has been improved; and the bifurcated needle is being substituted for the rotary lancet in the vaccination programme. Although reporting is still very incomplete and surveillance activities are still very limited, there appears to be a modest decline in incidence from 1968.

General Programme Activities

In the development of the eradication programme, initial efforts were directed toward the development of the technical and operational strategy. These were fully discussed by a Scientific Group on Smallpox Eradication which met in October 1967 and presented in a report (Technical Report Series No. 393). A "Handbook for Smallpox Eradication" was also written, which will be revised during 1969 to take into account the experience of the past two years. Additionally, a special manual which discusses the theory and practice of surveillance-containment operations was prepared.

Special seminars dealing with programme execution have been conducted in 1967 for countries in Asia and in November 1968 for countries in eastern and southern Africa. Others are being planned.

Because of the critical need for adequate supplies of freeze-dried vaccine which meet standards established by WHO, major efforts have been devoted to this problem. Assistance in the form of consultation, vaccine testing, equipment (in conjunction with UNICEF) and antigens for testing have been provided to laboratories throughout the world. To date, WHO consultants have visited 24 production laboratories; equipment, special reagents and testing materials have been provided to 30 laboratories. All countries have been urged to submit vaccine specimens regularly for testing purposes. These are tested either at the Rijks Institute, Netherlands, or the University of Toronto, Canada. This service has been increasingly used as shown in the following table:

	1965	1966	1967	1968
No. of samples tested	12	43	83	167

A group of specialists in freeze-dried smallpox vaccine production met in April 1968, and developed a detailed manual describing the production of freeze-dried smallpox vaccine as grown on animal skin.

The needs for freeze-dried smallpox vaccine still exceed the production capacity in most endemic countries; other countries not sufficiently populous to support a vaccine production laboratory depend on vaccine donations to execute their programmes. Bilateral donations by the USSR of approximately 100 million doses per year and by the USA for countries in this region take care of most of the need. In addition, 14 countries have made donations to WHO. The amount of vaccine distributed by WHO has steadily increased as shown below:

	1965	1966	1967	1968
No. of doses distributed (in 000's)	2,290	3,767	13,008	19,746

It is satisfying to note that almost all vaccinations now performed in endemic countries are performed with freeze-dried vaccine which conforms to the potency standards recommended by WHO. At the inception of the programme two years ago, it is doubtful that more than a quarter of the vaccinations in endemic countries were performed with satisfactory vaccine.

Recommended vaccination techniques have been altered substantially to provide simpler methods which assure higher take rates and use smaller quantities of vaccine. In 1967, the foot-operated jet injector was first employed for routine field operations after several years of testing and evaluation. It is now in widespread use in Brazil, in the Democratic Republic of the Congo, as well as in the countries of this area. It is being employed also in several other countries for special programmes of epidemic containment and for vaccination of large groups. Early in 1968, after a number of special field studies, the bifurcated needle was introduced for field use and has now been adopted in essentially all programmes. Employing bifurcated needles, vaccinators in eastern Africa have been able to vaccinate 400-500 persons daily, while realizing savings of several fold in vaccine. By the end of 1969, virtually all vaccinations in endemic countries will be performed either with the jet injector or the bifurcated needle, techniques unknown to routine vaccination programmes prior to the beginning of the global eradication effort.

Since the inception of the global programme, the importance of more complete reporting of cases of smallpox has been stressed and the majority of countries have made special efforts to strengthen their reporting and surveillance activities. In addition to various administrative measures to assure the regular notification of cases from health facilities throughout their countries, several have initiated the telegraphic reporting of cases; special case investigation teams have been established in many areas; and smallpox surveillance reports are now published regularly by five countries.

To facilitate the more rapid exchange of current information regarding the global status of smallpox and eradication activities throughout the world, WHO has, since June 1968, prepared a special surveillance report on smallpox which is published every two weeks in the Weekly Epidemiological Record. To permit more rapid and detailed analysis of disease trends, smallpox morbidity data is now being recorded and tabulated by computer.

Intercountry co-ordination of surveillance as well as vaccination activities is assuming increased importance and to facilitate this activity, special WHO teams will be created next year.

Reliable reporting rests in large measure upon the accurate clinical diagnosis of the disease. To assist health personnel and others responsible for the reporting of smallpox, WHO is producing initially for the African countries and subsequently for those in Asia, a series of teaching aids, including posters and slides, which show cases of smallpox and varicella at different stages of the evolution of the rash. During October 1968, a WHO staff member and a photographer obtained 4,000 pictures of African patients with smallpox and varicella. These should be ready for distribution in a few months. It is anticipated that a similar series of photographs of Asian patients will be obtained during 1969.

A network of diagnostic laboratories to provide geographically convenient diagnostic services to every country is also being developed by WHO. It is planned for each participating laboratory to be able to conduct at least three basic examinations for the identification of variola virus; a microscopic smear examination, a precipitation-in-gel test and definitive identification through virus isolation on the chorioallantoic membrane of chick embryos. A 48-page manual has been prepared entitled "Guide to the Laboratory Diagnosis of Smallpox" which describes in detail and pictorially each of the tests noted. Arrangements have been made with collaborating laboratories to produce requisite antisera and antigens and additional materials for each of the tests have been procured.

Training courses have already been conducted in the Americas and a network of 12 diagnostic centres established. During 1969 and 1970, it is planned for additional courses to be conducted in other regions. Following the training course and the designation of laboratories as diagnostic centres, arrangements are being made to distribute twice each year to each of the laboratories specimens as "unknowns" to ensure that each of the laboratories has retained its competence or, if not, to assist in retraining the technicians concerned.

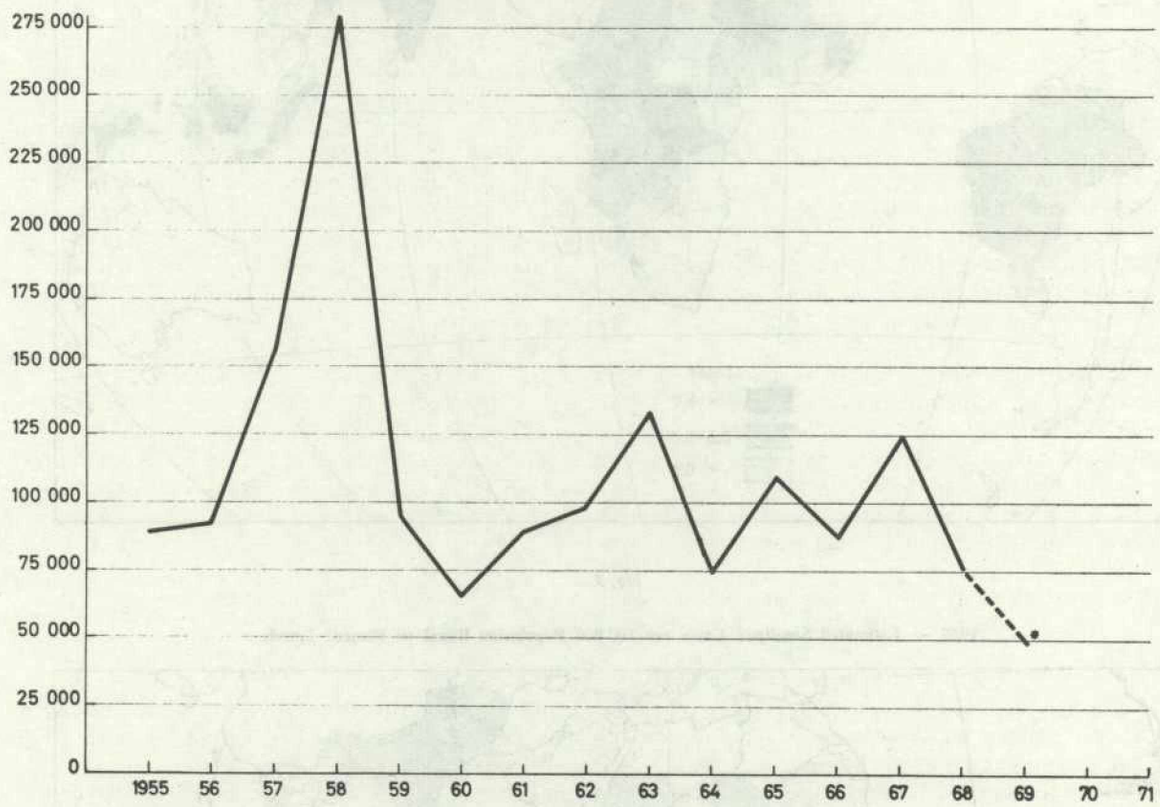
Research studies of many types are also being fostered or sponsored by WHO.

Summary

As I hope to have portrayed, the past three years have been active ones indeed, not only in this part of Africa but throughout the world. We are now beginning to see some very concrete results but this is, of course, only a beginning. As yet, no major endemic region has become smallpox-free and this, after all, is our real objective. If the target of a space programme is to land a man on the moon, the programme can hardly be termed a success if the man only gets part way there. We, therefore, await, with great anticipation, the day when countries in this vast area consistently record nil cases of smallpox, a day that is hopefully only months in the future.

Fig. 1

Reported Cases of Smallpox in the World — 1955-1969



* Estimated on present trends.

Fig. 2

1968 — Smallpox Cases per 100 000 Population

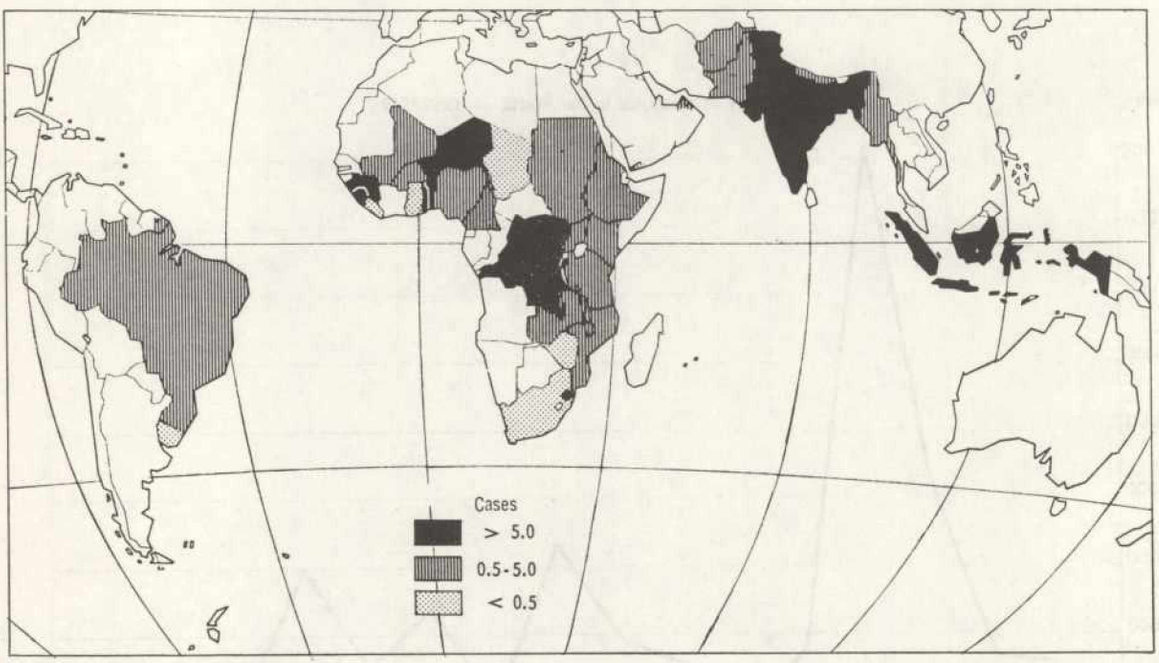


Fig. 3

1969 — Estimated Smallpox Cases per 100 000 Population Based on Present Trends

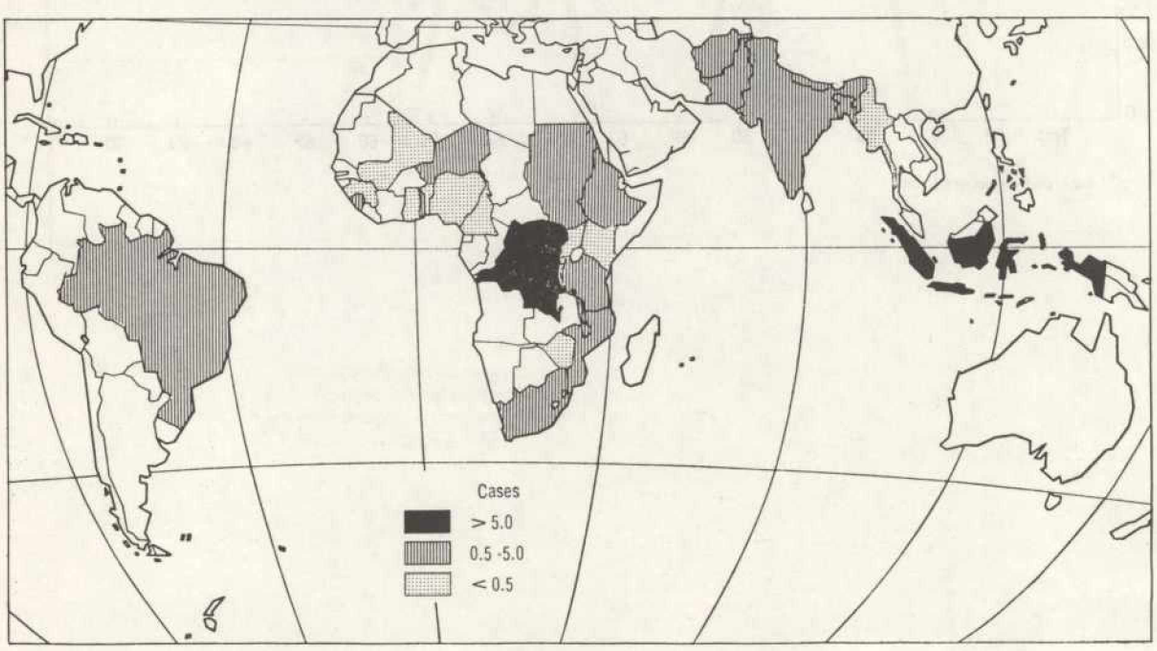
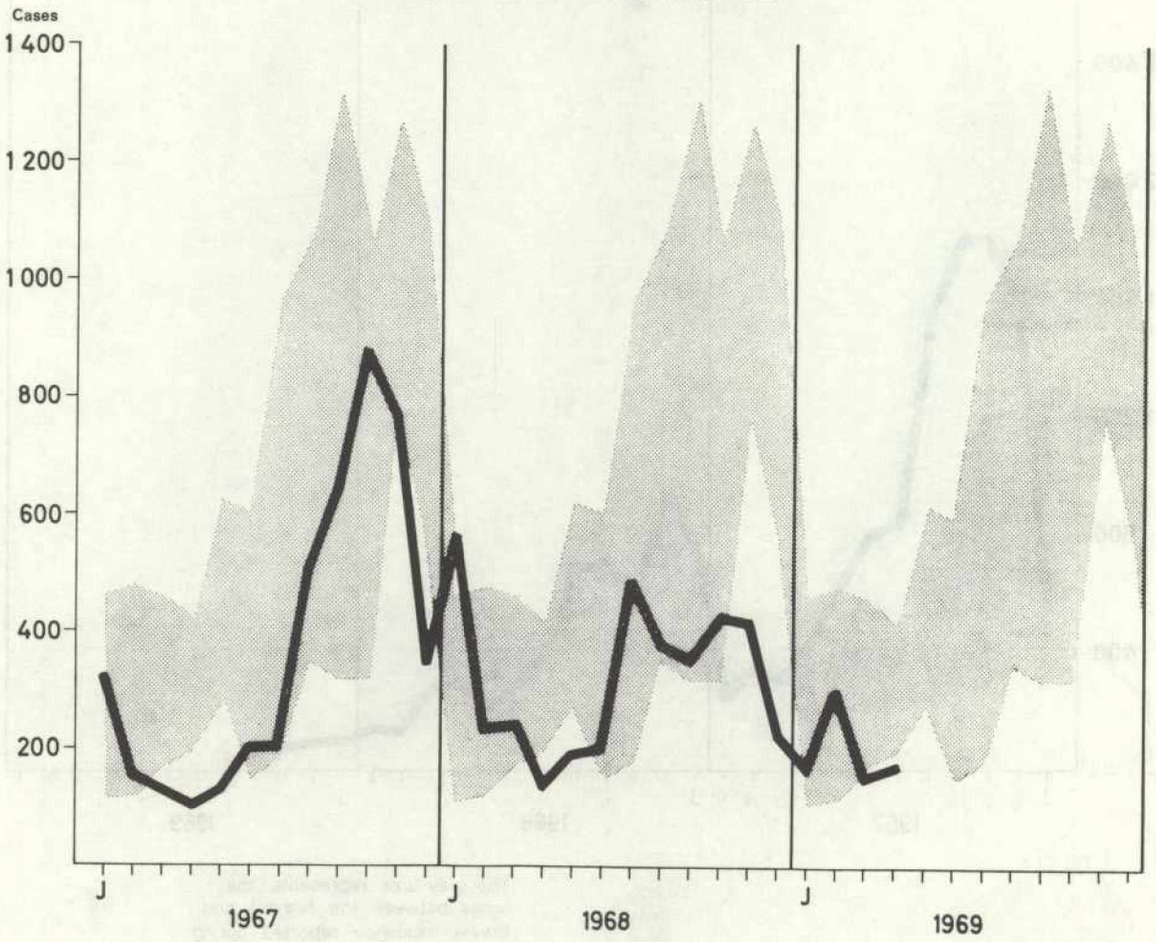


Fig. 4

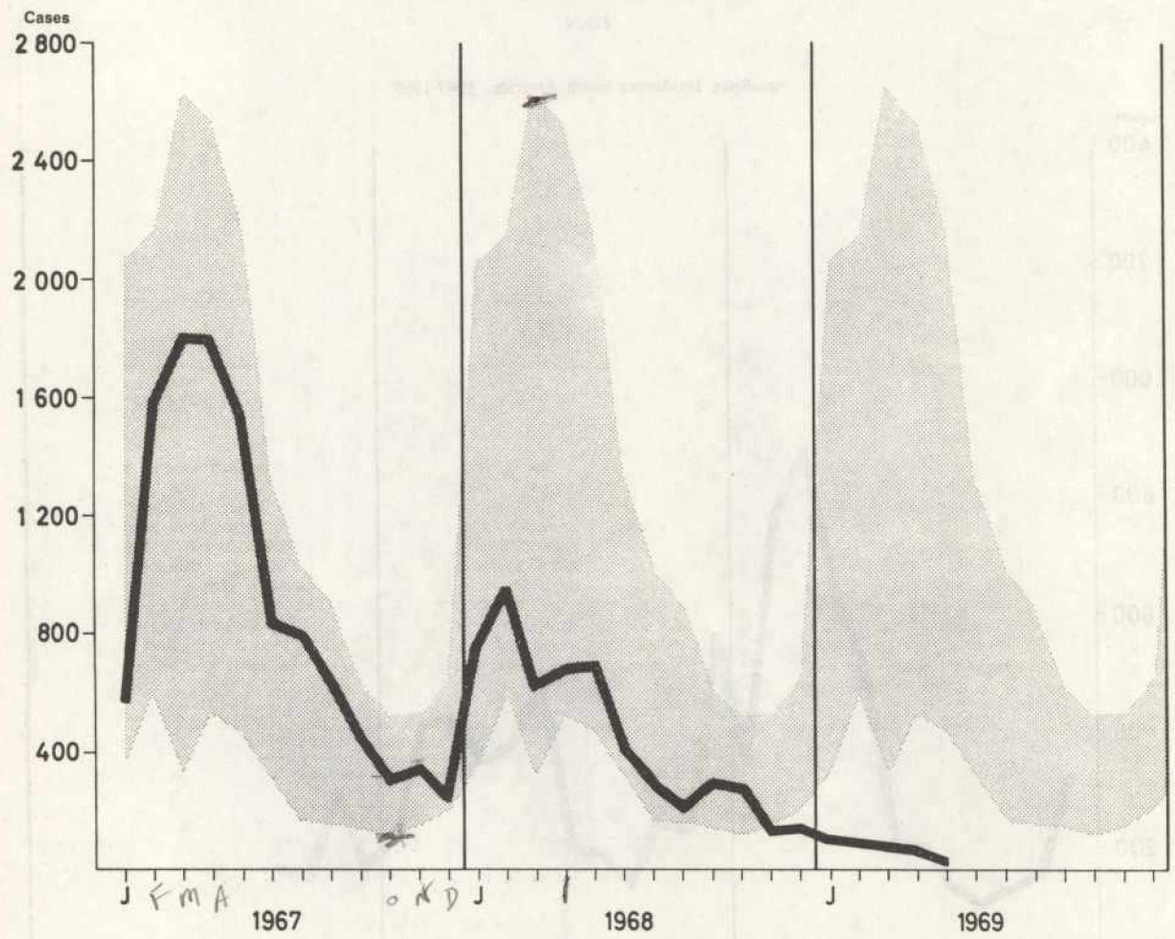
Smallpox Incidence: South America, 1967-1969



The grey area represents the range between the highest and lowest incidence reported during the 5-year period 1962-1966

Fig. 5

Smallpox Incidence: Africa, West and Central, 1967-1969



The grey area represents the range between the highest and lowest incidence reported during the 5-year period 1962-1966

Fig. 6

Smallpox Incidence: Africa, East and South, 1967-1969

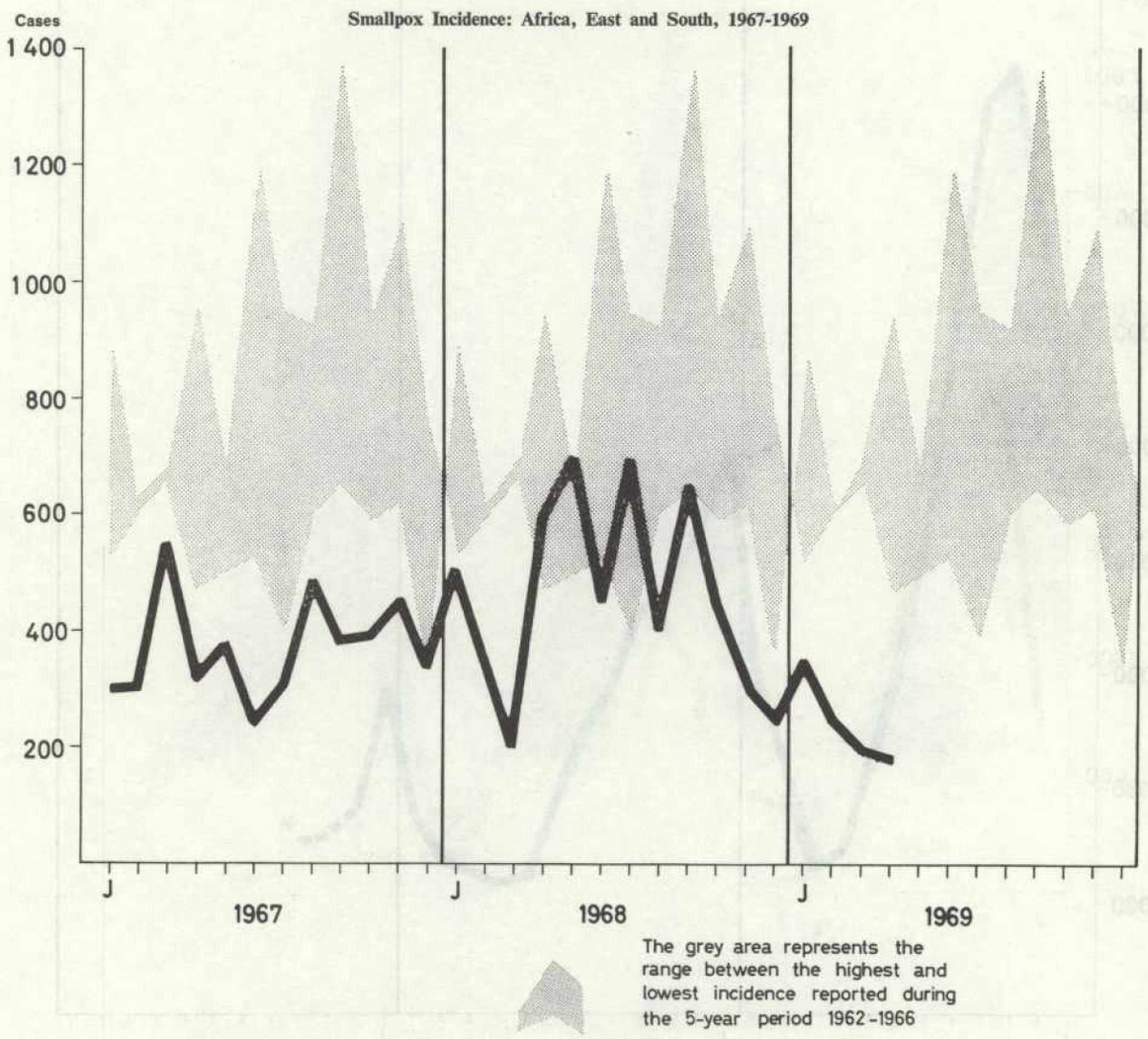
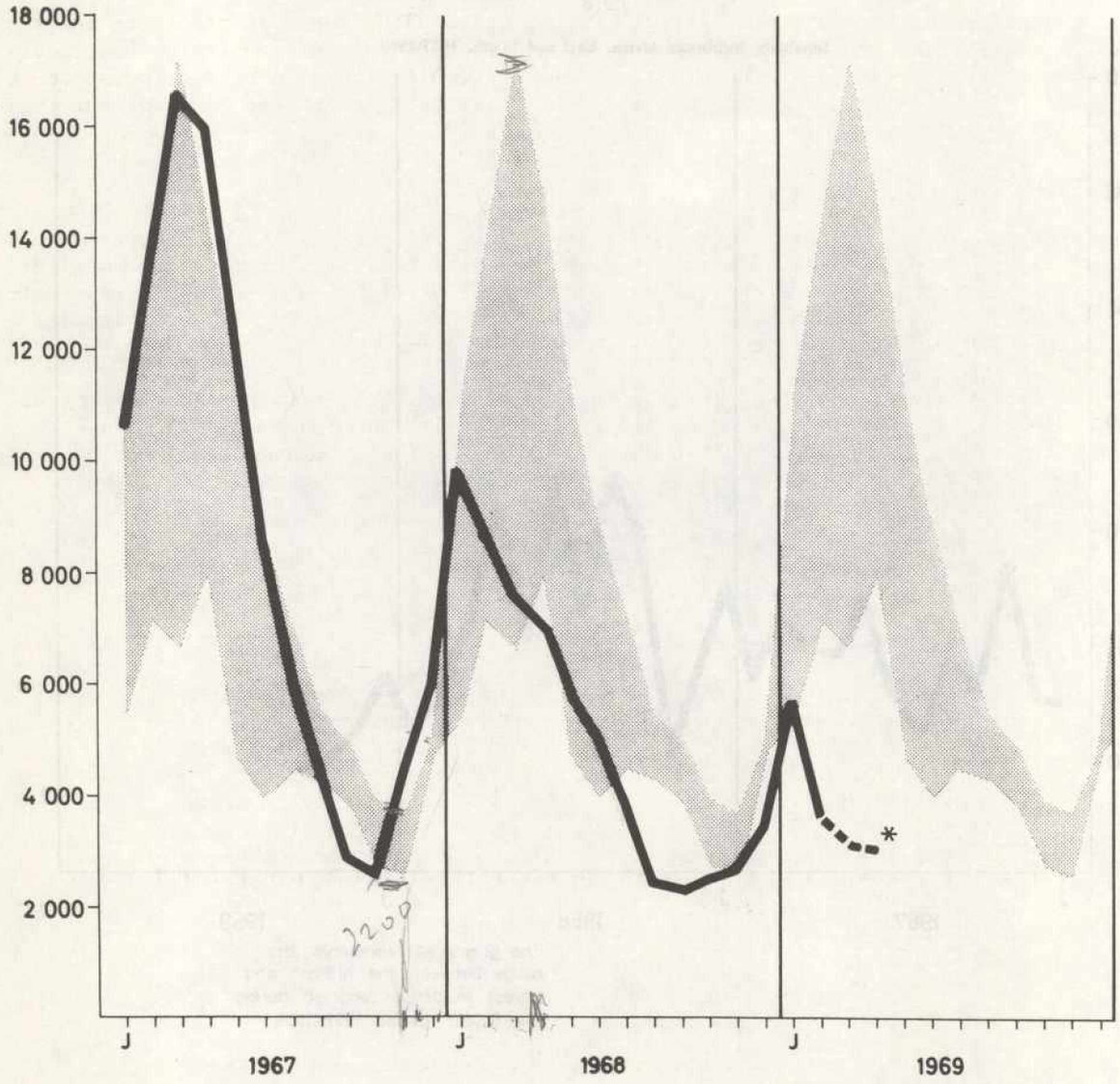


Fig. 7

Smallpox Incidence: Asia, 1967-1969



* Provisional Data.

The grey area represents the range between the highest and lowest incidence reported during the 5-year period 1962-1966

DEVELOPMENT AND STATUS OF THE SMALLPOX ERADICATION AND MEASLES CONTROL PROGRAMME IN WEST AFRICA

J. D. Millar[1]

INTRODUCTION

In this introduction, I should like to review briefly the terms of reference and the goals under which this programme was developed, and the progress which we have made. I should like particularly to note those areas in which I feel more must be accomplished for it is these areas which should particularly occupy the focus of our attention during the course of the seminar.

BACKGROUND

In 1966, after consultation with the various Ministries of Health, a document was produced at the National Communicable Disease Centre entitled "Project for Smallpox Eradication and Measles Control in 19 countries of West Africa". Those of you familar with the language of USAID will recognize this as the "Draft E-1", the initial plan for the regional programme.

The objectives were outlined as follows; "The primary goal of this regional project is the eradication of smallpox from 19 geographically contiguous countries in West Africa .... and the establishment of measles control programmes in each of these". The document laid out five secondary objectives to be realized in the pursuit of smallpox eradication and measles control:

"1. The establishment, or in some countries improvement, of mobile disease control services capable of administering vaccines or other preventive medications efficiently, economically, and on a mass scale throughout the country.

2. The establishment in each country of a system of disease surveillance broadly applicable to a variety of communicable disease problems. Such a disease surveillance system includes the development of effective disease reporting mechanisms, epidemiological field investigations of specific problem areas and educative techniques designed to acquaint responsible medical personnel throughout the country with current problems of development related to the occurrence and control of the diseases of concern.

3. The development of highly simplified statistical sampling techniques applicable in these developing countries which will permit rapid assessment of disease problems.

4. The establishment of elementary virological laboratories in many of the countries capable of simple laboratory procedures for the diagnosis of smallpox.

5. Improvement of the existing smallpox vaccine production laboratory in Yaba, Nigeria, such that it is capable of producing stable, potent, safe vaccine of the multiple puncture type economically and in quantities sufficient for Nigeria and other countries in this area".

[1]Director, Smallpox Eradication Programme, NCDC, Atlanta, Georgia, USA

The document provided guideposts for the measurement of progress in the programme as follows: "If the projected plan can proceed as scheduled, indigenously transmitted smallpox cases should cease by the end of the fourth year of the programme; by this time measles should be reduced to a level of sporadic occurrence or at most small focal outbreaks".

With regard to the last two objectives, it may be noted that the laboratory in Yaba now produces vaccine which meets WHO standards in all respects. There is a well functioning diagnostic laboratory in Nigeria, and intermittent diagnostic work is being done by other laboratories, principally in Ghana, but a comprehensive system of diagnostic services for all countries does not yet exist. The description of our progress in achieving the remaining objectives merits a more detailed review.

PRESENT STATUS OF OPERATIONS IN WEST AFRICA

Mass vaccination assessment and surveillance are the three major operational elements of the original comprehensive plan. We must, in retrospect, add one more, perhaps not so clearly seen in the original plan - maintenance activities.

MASS VACCINATION

There is no question but that each country has capably performed collecting point mass vaccination campaigns. Those countries, including most of the francophone countries, who had mobile immunization systems prior to the present regional programme, have continued to prosecute these vigorously. Other countries have developed such systems de novo to a high degree of effectiveness. Witness the fact that from January 1967 to the end of April 1969, 78.2 million smallpox vaccinations and 12.4 million measles vaccinations were performed. No country has failed to mount a successful mass campaign; despite political and social turmoil, as well as economic problems, mass campaigns have been sustained. Only where lack of transport has supervened have they been restricted. Among the 19 countries are 3 different systems of operation ranging from prospection team activities with several target diseases, to systems such as those in Upper Volta and Ivory Coast where the antigens of smallpox and measles are given by different organizations (Table 1). In most countries, the average output of vaccination teams has been good. In others, particularly those operating by prospection, the number of vaccinations per day is low enough to suggest that vaccination by Ped-O-Jet might economically be replaced by vaccination by bifurcated needle.

Overall, however, the programmes have been remarkably successful. This is particularly notable when one compares the progress to date with the objectives established at the beginning of the programme (Figure 1).

ASSESSMENT

Table 2 summarizes the Programme's status with respect to the statistical sampling assessment technique. Nine countries are presently conducting systematic assessments to determine vaccination coverage in the population. These assessments are generally carried out by formally constituted assessment teams established for the purpose. In another four countries, assessment activities have been carried out at intervals and under varying circumstances. There remain six countries in which continuing assessment of vaccination coverage has not been incorporated as a part of the national programme.

The most recent results obtained in assessments are shown in Table 3. Most countries conducting systematic assessments have determined that their vaccination programmes are reaching 80 percent or more of the population in most age groups. Groups with poor coverage have been identified and operational procedures modified in order to improve coverage. Notably, the over-45 year age group has been consistently identified as the one most difficult to reach.

Later in the conference, the so-called "terminal" or phase I assessments will be described. These have been conducted on a nationwide basis in Gambia, Gabon, Niger, Togo and Dahomey, and on a statewide basis in Northern and Western Nigeria. In brief, the terminal assessments have generally confirmed the adequacy of vaccination coverage in the various countries although acceptable levels were not reached in all. The assessments, however, have emphasized clearly that adequate population coverage is a momentary thing. There is a continuing dilution of population immunity as susceptibles, principally newborns, enter the population to constitute an ever-increasing reservoir for outbreaks. A constant awareness of this becomes critically important as one plans for maintenance activities to prevent the re-establishment of smallpox.

Assessment has also confirmed one of the attested advantages of administering smallpox vaccination by jet injection, i.e. the invariably high vaccination "take rates", even under sub-optimal conditions. As suggested by the original evaluations in the United States, Jamaica, and Brazil, the consistently high proportion of take rates obtained stands in contrast to the wide variability of "take rates" observed in programmes employing scratch vaccination or multiple pressure vaccination.

That there are still countries without formal assessment activities is to be deplored. Those countries deny themselves the security of assurance that their country's programmes are adequate. Of greater concern, these countries lack critical information on the extent and location of areas of poor coverage. As the entire region moves into maintenance vaccination activities, the vaccination of newborns and poorly vaccinated groups in particular geographic areas become increasingly important. To operate without formal assessment of coverage makes it virtually impossible to appraise the situation with accuracy.

SURVEILLANCE

While vaccination programmes in West Africa have been a clearcut success and assessment techniques, while less universally implemented, have proven their worth, progress in the surveillance component is more difficult to appraise. An adequate surveillance system consists of (1) a mechanism for reporting the disease (2) interpretation of the reported data, and (3) prompt response in the investigation and control of outbreaks which are identified.

Only nine countries are systematically reviewing the efficiency of their reporting systems by determining if the number of reports received from reporting sites is consistent with the number expected. In these countries, the efficiency of reporting, as measured in terms of reports received to reports expected, varies from as low as 30% to 100% (Table 4).

The "eradication escalation" exercise, which began in September 1968 and involved all 9 countries with endemic smallpox has encouraged more efficient identification of outbreaks and, particularly, more intensive outbreak control activities. However, even in these countries, one-half of the cases identified since October were detected by an active search for cases rather than through the routine reporting system.

With regard to the ability to react quickly and effectively when outbreaks are reported, one is struck by the variability between countries in the region. In some countries, the response of the local health authorities to reported smallpox is prompt and control vaccinations in limited areas surrounding the case are immediately undertaken. However, prior to September 1968, there were a number of smallpox endemic countries in which the response to reported cases was virtually nil. Even now, the response to reported outbreaks of measles is, in most countries, nil.

Surveillance must become an increasing pre-occupation with all of us. Programmes involving the active search for smallpox cases cannot last forever no matter how

successful they may be. Ultimately, reliance will have to be placed on the routine reporting system. Every effort must be made to see that a report, either positive or negative, is received from every reporting site at least once a month. The threat of re-introduction of smallpox is real. I need only mention Ethiopia where smallpox exists in abundance and which has probably been responsible for infecting Sudan both last year and this year. I must also cite the Democratic Republic of the Congo where an active smallpox eradication programme has not yet eliminated many areas of intense smallpox transmission. These countries are principal potential exporters of smallpox to West and Central Africa.

At the present time, only four countries have established surveillance newsletters or reports to provide analysis of the reported surveillance data for distribution to the people at the reporting source. Those reports which have been prepared have been done with considerable imagination and, in each instance, evidence exists to confirm that these have encouraged improved reporting. The investment of time in such a document is minimal. The fact that such reports do not exist in every country suggests in part a lack of success in emphasizing the importance of informing the field personnel of the use of the data reported.

Before leaving surveillance, I am obliged to comment on the quality of the epidemiological investigations. The ability to respond to reports of outbreaks with a complete and careful investigation is integral to the surveillance reflex arc. We have seen in West Africa the encouraging development of outbreak control or fire-fighting capabilities. We have not, however, seen a concomitant increase in the quality of epidemiological field investigations. Although everyone knows that smallpox cases do not occur as sporadic isolated phenomena, most of the field investigations reported are not sufficiently complete to permit an analysis of the infectiousness of smallpox, the period of infectivity, the source of disease, and the influence of living patterns on transmission. As from now, suspected cases of smallpox in West Africa will assume the same critical importance that they do in Europe and North America. The quality of epidemiological investigations and the intensity of control efforts will have to match those presently practiced in Europe or smallpox will surely be re-established.

MAINTENANCE

Some 11 countries have begun maintenance activities principally directed as measles control in urban areas. Maintenance activities will be an important topic in this meeting. Essentially all countries will complete the "attack phase" of mass vaccination this year, commodities permitting. Brilliant as the mass campaigns have been sustained freedom from smallpox, and the hope of measles control rests specifically on maintenance operations.

Maintenance consists of three principal elements: (a) effective and early immunization of incoming susceptibles, principally newborns, (b) the assessment of maintenance activities to assure that incoming susceptibles are reached in high proportion, (c) surveillance and epidemic control to permit the identification of suspected smallpox cases or measles outbreaks and the ability to respond with effective control measures.

Maintenance activities for both smallpox and measles are nationwide at present only in two countries, The Gambia and Gabon. In other areas, they are directed principally at cities. Ivory Coast is conducting nationwide smallpox maintenance activities. But before the present year is out, maintenance activities for both diseases must be planned in every country in the region.

It is highly likely that the requirements for measles control will demand in the maintenance phase a level of activity which exceeds original planning. Countries must confront these realities now, and decide whether the goals for measles control are realistic, and if so, plan to accommodate them.

INNOVATIONS

There have been several extremely important developments in this programme which I think are unique. In view of the impact of the West African Programme on the conduct of smallpox eradication programmes around the world, these are in my judgement, worth review.

(1) This programme has demonstrated the importance of the non-medical and administrative health workers in a major disease control programme. The demonstration that non-medical operations officers could effectively organize smallpox eradication activities and conduct epidemiological investigations is an important contribution. It is consistent with the African aim to use wisely all available manpower resources. It is a contribution of considerable worth in the long-term development of health personnel resources throughout the world.

(2) The use of concurrent statistical sampling assessment of a mass campaign while not universally practiced, has been more widely employed in this programme than in any other African or Asian health activity. The utilization of the information in studying the dynamics of accumulating susceptibles provides the West African Programme a greater assurance of its moment-to-moment status than exists elsewhere.

(3) The concept of "eradication escalation" which seizes upon an epidemiological situation of a few cases to promote intensive case identification and outbreak control efforts, is a new concept which is clearly identified with this programme. The last six months have proven the efficacy of this approach, one which is now being adopted in other areas.

(4) The development of a vast regional programme based on vaccination by jet injection is also unique to the West African Programme. This programme has clearly shown that the Ped-O-Jet can be employed as the principal instrument in a mass vaccination programme and has provided an understanding as to the circumstances under which jet injection vaccination should be practiced for greatest efficiency.

(5) Finally, the remarkable degree of international co-operation involved in this regional programme must stand as unique in the history of disease prevention. The countries in West Africa have, for purposes of the fight against smallpox and measles, permitted their borders to be penetrated by teams from adjacent countries, have rapidly exchanged information on the existence of smallpox cases, and have co-ordinated mass campaigns in order to provide the most effective and timely coverage of common borders.

DISCUSSION

I have discussed the major operational aspects of the Smallpox Eradication and Measles Control Programme. The mass vaccination campaign is now a fact of life in Africa, assessment is being practiced by many but not all countries, surveillance needs much strengthening, and maintenance activities are a still irregular and non-universal part of the programme. Maintenance activities, with continuing assessment, surveillance and epidemic control, will determine whether or not smallpox eradication is permanently achieved. Measles control, furthermore, as we shall discuss, is ultimately dependent on them.

You have virtually achieved the interruption of smallpox transmission, well ahead of schedule; measles control still appears far in the future, if in fact attainable on a regional basis. The maintenance of smallpox eradication and the achievement of measles control will require of all of us greater endurance, persistence, and imagination. The glamour of the mass campaigns will soon be over. The hard, unattractive, but crucial work of maintaining what has been achieved, must now proceed.

Table 1

Most Recent Information Regarding Activities
Smallpox Vaccination Team

Country	Type Team	Date Last Report	No. Teams	Average Vacc. Per Team Day
Cameroon	Prospection	Feb.	24	+
C.A.R.	Prospection	Feb.	5	+
Chad	Prospection	March	+	+
Congo	Prospection	+	+	+
Dahomey	SM	Jan.	2	1410
Gabon	Prospection	Dec. '68	8	145
Gambia	SM	Feb.	2	163
Ghana	SM	Sept. '68	7	880
Guinea	SM	March	9	1677
Ivory Coast	S[1]	Nov. '68	8	614
Liberia	SM	Dec. '68	6	173
Mali	SM	Feb.	6	-[4]
Mauritania	SM	Feb.	N.A.	N.A.
Niger	SM	March	5	1503
Nigeria	SM	Nov. '68	37	2523
Senegal	SM	Feb.	7	1164
Sierra Leone	SM	March	7	2621
Togo	SM[2]	March	3	1659
Upper Volta	Prospection[3]	March	21	N.A.

\+ Data not available on a monthly basis.
1. Measles immunization performed by a separate organization.
2. During January and February, 10-20 special teams using multiple pressure technique averaged 180-375 vaccinations per day.
3. Smallpox vaccination performed by prospection teams, measles vaccination by unipurpose teams.
4. Teams unable to operate due to inoperable trucks.
5. Gambia is presently in the maintenance phase having successfully completed the mass attack phase in Spring 1968.

Table 2

Assessment Activities

Systematic Assessment	Ad hoc Assessment	No. Assessment
Chad	C.A.R.	Cameroon
Ghana	Gambia	Gabon
Guinea	Senegal	Ivory Coast
Liberia	Dahomey*	Upper Volta**
Mali		Congo B.
Niger		Mauritania
Nigeria		
Sierra Leone		
Togo		

* Just formed an assessment team.
** Assessment teams are planned for FY 1970.

Table 3

Latest Available Data Regarding Vaccination Coverage Figures for Countries doing Systematic Assessment

Country	Latest Figures	Percent Vaccination by Age 0-4	5-14	15-44	45+	Total	Take Rates 0-4 Yrs.
Chad	February	63	74	83	88	78	100
Ghana	September	94	96	93	80	93	93
Guinea	March	91	94	88	85	90	99
Liberia	November	84	92	88	82	83	100
Mali	January	100	93	94	96	95	NA
Niger	March	82	90	67	26	74	100
Nigeria*	February	91	86	-68	-	77	-
Sierra Leone	March	90	89	80	74	84	100
Togo	February	100	100	100	100	100	99

*Data for Gombe town, Northeastern State in categories 0-3, 4-14, 15+ yrs.

Table 4

Efficiency of Surveillance in Countries Consistently Reporting (to NCDC) Analyses of Reporting Systems

Country	Date Last Report	Number of Reports Requested	Number of Reports Received	Percent
C.A.R.	February	5	5	100
Chad	February	45	44	98
Gabon	December	30	16	53
Gambia	March	128	94	73
Guinea	March	32	10	31
Mali	February	42	38	90
Niger	February	76	49	64
Nigeria				
Kaduna	February	152	76	50
Ibadan	February	72	72	100
Togo	March	75	75	100

SMALLPOX

EPIDEMIOLOGY OF SMALLPOX IN WEST AND CENTRAL AFRICA

W. H. Foege[1]

TEMPORAL OCCURRENCE

The seasonal pattern of smallpox in West Africa consists of a marked increase in cases from most countries during the dry season, and a decline with the onset of the rainy season. However, some countries, particularly coastal countries, do not show this pattern and some record as many or more cases during the rainy season. Generally, however, smallpox can be characterized as a dry season disease in West Africa.

Superimposed on the seasonal pattern of incidence is a long term cycle with epidemics every four to seven years. Figure 1 shows in dotted lines the average number of reported cases by month between 1960 and 1967. Reports for 1968 are far below the average of the previous seven years, and in early 1969 the expected seasonal rise has not materialized. One must ask whether this might reflect a longer term trend, with 1969 representing a low year which happened to coincide with the completion of the initial mass vaccination programme. However, even if compared with previous low years, the 1969 figures are still extraordinary. For instance, in Nigeria, the lowest previous year was 1964, but cases recorded during 1969 are 84% lower than this. Other comparisons by country are similar and lead to the conclusion that the pattern seen in 1969 is an unusual pattern, never previously observed, and not simply part of a long-term trend.

GEOGRAPHIC DISTRIBUTION

The extension of smallpox-free areas is another indication that 1969 could be the year of eradication. In 1963, all of the 19 countries in the Programme reported cases of smallpox, either officially or unofficially.

In 1967, 14 of the 19 countries reported smallpox; in 1968, 12 of the 19 countries reported smallpox; but, in April 1969, only 5 of the 19 countries were still reporting smallpox and only one of the five reported more than three cases.

In 15 months, between January 1968 and March 1969, both the geographic areas recording smallpox and the numbers of cases in these areas have declined (Figure 2). This is particularly dramatic when it is recalled that West Africa in the past three years has recorded some of the highest smallpox rates in the world (Table 1). In 1967 when the current vaccination programmes first began in West Africa, the five highest rates by country in the world were found in West Africa. Sierra Leone, for example, had a rate over four times as high as India.

THE SMALLPOX CASE

The age distribution of smallpox is dependent on the age group exposed and the immunity levels in that age group. In some areas of the world, smallpox is a disease of the pediatric age group: immunity resulting from past vaccination campaigns as well as from smallpox itself gradually increases with age, leaving relatively few susceptibles in the older age groups. While some outbreaks in West Africa have followed this pattern, the age distribution of smallpox cases in West and Central Africa follows very closely the age distribution of the population (Table 2). In particular, the 2,327 cases with known age, reported since January 1968, have shown an age distribution very close to the age distribution of the population as a whole. As smallpox in West and Central Africa is a disease of all age groups, the mass vaccination campaign must similarly be directed at all age groups.

[1]Chief, West African Operations, Smallpox Eradication Programme, NCDC, Atlanta, Georgia, USA

Table 3 compares smallpox mortality ratios by age groups in 1,118 patients from outbreak investigations in several countries and 1,090 cases reported from the Kano Infectious Diseases Hospital. In both groups, children under the age of one and persons over the age of 45 had the highest case fatality ratios. Both series, except for the under one age group, show similar age specific mortality ratios.

Among investigated cases, only 4% of patients under the age of 14 had a history of smallpox vaccination, but over the age of 45, over 50% gave a history of smallpox vaccination (Table 4). The percentage of cases who had a vaccination scar was considerably lower than the proportion who gave a history of vaccination. Among 124 cases under the age of 14 who were examined, 2 (1.6%) had scars, while among the entire group of examined cases only 6 of 185 (3.2%) had scars. The marked discrepency between vaccination histories and presence of vaccination scars may be due to confusion in referring to other injections as "vaccinations", or it may reflect the known use of much impotent vaccine in the past.

SPEED OF TRANSMISSION OF SMALLPOX

One of the important observations in the present programme is that smallpox spreads with much more difficulty than previously appreciated. In table 5, several instances are cited in which over 50 days elapsed from the onset of symptoms in the first case in a compound to the onset of symptoms in the last case in the same compound even when only 4 or 5 susceptible persons resided there.

As many as 80 days have elapsed in a single compound between onsets of symptoms in the first and last cases when only 15 susceptible persons resided in the compound. A highly contagious disease would exhaust susceptibles much more rapidly.

Another indication of the difficulty which smallpox has in spreading is found in the susceptible exposure index. This rate relates cases of smallpox to number of exposures. If 100 persons were exposed to smallpox and one generation later all 100 persons developed smallpox, the rate would be 100 cases per 100 susceptible exposures. On the other hand, if 50 developed smallpox after one exposure and 50 more during the second generation of cases the total number of susceptible exposures would be 100 during the first generation and 50 during the second generation (50 already having developed the disease) or an overall total of 150 susceptible exposures among whom there were 100 cases - a rate of 100/150 or 66.7%. Examples cited in Table 5 show between 26 and 44 cases of smallpox per 100 susceptible exposures. For comparison, the rate would be approximately 80 cases per 100 susceptible exposures for measles. Smallpox is not a highly contagious disease but rather a disease which spreads with some difficulty.

Slow transmission allows smallpox to persist in a single compound for a long period while an increase in transmissibility would shorten the time which smallpox lingered in a given compound, it would also result in an increase in the number of compounds involved. Any increase in transmissibility would approach the measles situation and would make eradication more difficult. The finding of slow transmission is not only an indication of the inherent difficulty experienced by smallpox in maintaining itself, but it is also an asset to the Programme since it makes control of outbreaks feasible before they reach large proportions.

Summary:

(1) The decrease in reported smallpox cases in West and Central Africa far exceeds that which would be expected from long-term trends and it is associated with a decrease in the geographic areas involved.
(2) Some of the same countries reporting no smallpox in the past several weeks reported the highest rates in the world in 1967 and 1968.
(3) The age distribution of smallpox in West Africa is similar to the age distribution of the population in West Africa.

(4) Mortality rates are highest in the under 1 and the over 45 age group.
(5) Vaccination scars are rarely seen in smallpox cases under 15 years of age.
(6) Only 3.2% of smallpox cases examined had evidence of a past vaccination scar.
(7) Smallpox spreads with great difficulty and this in turn is a definite asset in achieving eradication.

TABLE 1

World's 12 Highest smallpox incidence rates by country (per 100,000 population) 1966, 1967, 1968

1966		1967		1968	
Rate	Country	Rate	Country	Rate	Country
64.2	French Somaliland	68.3	Sierra Leone	45.4	Sierra Leone
35.4	Niger	40.2	Guinea	41.7	Togo
23.0	Dahomey	32.1	Dahomey	23.2	Congo, D.R.
13.1	Sierra Leone	31.7	Niger	18.2	Niger
13.0	Burundi	17.3	Togo	14.5	Dahomey
12.5	Congo. D.R.	15.3	India	13.3	Indonesia
12.4	Togo	13.4	Tanzania	9.9	Pakistan
11.1	Indonesia	11.7	Indonesia	8.6	Guinea
10.1	Swaziland	10.4	Pakistan	8.1	Burundi
8.7	Nigeria	9.0	Congo D.R.	4.8	India
8.0	Uganda	7.8	Nigeria	3.7	Tanzania
6.8	India	5.1	Brazil	3.7	Brazil

Countries of West and Central Africa are underlined.

TABLE 2

AGE DISTRIBUTION OF SMALLPOX CASES IN WEST AND CENTRAL AFRICA(1)

January - December 1967

Age	Number of Cases	Per Cent Distribution of Cases	Percentage Distribution of West African Population (2)
< 1	23	1.5	4.3
1-4	299	19.6	14.5
5-14	413	27.0	25.1
15-44	678	44.4	42.0
45+	115	7.5	14.0
Total	1528	100.0	99.9

January 1968 - February 1969

< 1	103	4.4	4.3
1-4	405	17.4	14.5
5-14	593	25.5	25.1
15-44	1006	43.2	42.0
45+	220	9.5	14.0
Total	2327	100.0	99.9

(1) Reported from investigations in Nigeria, Guinea, Togo, Cameroon, Dahomey, Mali, Niger, Ghana, Chad, Upper Volta, Sierra Leone.

(2) United Nations Demographic Yearbook.

TABLE 3

SMALLPOX MORTALITY BY AGE GROUP
WEST AND CENTRAL AFRICA

A. Outbreak Investigations Conducted in Cameroon, Dahomey, Ghana, Mali, Niger, Nigeria, Sierra Leone, and Togo.

Age	Cases	Deaths	Case Fatality Ratio
< 1	33	15	45.4
1-4	228	20	8.7
5-14	290	20	6.9
15-44	392	89	22.7
45+	92	29	31.5
TOTAL	1118	173	15.5

B. Kano IDH Hospital - 1,090 Consecutive Admissions - Reported 1968.

Age	Cases	Deaths	Case Fatality Ratio
< 1	69	15	21.7
1-4	189	28	14.8
5-14	204	18	8.8
15-44	319	64	20.1
45+	11	4	36.4
Total	1090	129	11.8

TABLE 4

VACCINATION STATUS OF SMALLPOX CASES

A. Vaccination Status by History of Investigated Smallpox Cases*

Age	Number of Cases	History of Vaccination	Per Cent
<1	30	1	3.3
1-4	179	5	2.8
5-14	255	11	4.3
15-44	158	41	25.9
45+	17	10	58.8
TOTAL	639	68	10.6

B. Vaccination Status by Examination for Scar of Investigated Smallpox Cases*

Age	Number of Cases	Scar Present	Per Cent
<1	3	0	0
1-4	46	0	0
5-14	75	2	2.7
15-44	60	4	6.7
45+	1	0	0
TOTAL	185	6	3.2

*From outbreak investigations in Cameroon, Dahomey, Ghana, Mali, Niger, Nigeria, Sierra Leone.

TABLE 5

EXAMPLES OF SLOW SMALLPOX TRANSMISSION WITHIN A SINGLE COMPOUND

Source	Contacts in Addition to Index Case	Contacts Without History of Vacc.	Interval Between Onset of Symptoms in Index Case and Onset of Symptoms in last Compound Case
Nigeria (Abakaliki)	21	4	31 days
Nigeria (Abakaliki)	32	14	47 days
Nigeria (Abakaliki)	14	5	51 days
Cameroon (N'Game)	?	4	Approx. 53 days
Nigeria (Adepe-Ipiga)	30	27	Approx. 60 days
Nigeria (Gerere)	24	15	Approx. 80 days

Source	Smallpox Cases as Related to Susceptible Exposures: Smallpox Cases	Susceptible Exposures	Cases per 100 Susceptible Exposure
Nigeria (Abakaliki)	12	27	44.4
Cameroon (N'Game)	4	10	40.0
Nigeria (Gerere)	12	45	26.2

EXECUTION OF SMALLPOX ERADICATION-MEASLES CONTROL PROGRAMME IN GUINEA

Dr. El-Hadj A. Barry[1]

Before speaking of the smallpox eradication and measles control programme in Guinea, I must give you some information of our country's geographical, political and administrative structure, which is responsible for the success achieved by our smallpox eradication programme.

Geographical, Political and Administrative Structure

The Republic of Guinea has an area of 253,870 km^2 and a population of 3,694,657 or 14.6 inhabitants per km^2. It is divided into four natural regions, (Coastal, Central, Upper and Forest), which differ from one another in relief, climate, population density, rainfall and vegetation. The tropical sudan climate is characterized by two seasons - a seven-months' cold season followed by a five-months' dry season, which is little marked in Forest Guinea but notable in Upper and Central Guinea where there are wide discrepancies of temperature at certain times of the year.

Guinea is divided into 29 administrative areas, in each of which there is a chief medical officer. The health infrastructure includes a medical care service, including a hospital service, clinics, and a maternity hospital; maternal and child health units; a special major endemic diseases department; and traditional medicine centres. Each administrative area consists of a number of arrondissements of which there are 205 in the country. Each has a rural clinic supervised by a male nurse.

On the major road arteries linking Guinea with neighbouring countries, we have set up frontier posts which are manned night and day by a male nurse specialized in health control work. His function is to record population movements, to check that all persons passing in either direction have been vaccinated, and to detect and direct to the nearest medical centre any person suspected of having a disease that is within the province of the major endemic diseases service.

The administrative structure is modelled on the political structure down to the basic cell represented by the neighbourhood, village, hamlet, or production unit. The administrative area corresponds with the political federation, and the arrondissement with the political division. We have 8,000 basic Committees, in which we have formed local revolutionary power teams corresponding both to the administrative and the political infrastructure. There are nine teams in each Committee - a health team, production team, literacy team, town planning team, etc., each of which has to play his role.

[1]Médecin-Chef du Région, Guinea

TABLE 1 CASES AND DEATHS FROM SMALLPOX - 1940-1968 GUINEA

Year	Cases	Deaths	Vaccinations
1940	91	-	
1941	44	7	
1942	180	34	
1943	375	36	
1944	1,253	131	
1945	1,765	169	
1946	1,094	157	
1947	422	31	
1948	115	5	
1949	2	-	
1950	11	2	
1951	12	-	
1952	141	11	
1953	181	24	
1954	108	4	
1955	1,339	59	
1956	1,070	30	
1957	1,365	56	
1958	107	23	
1959	441	1	83,146
1960	176	-	9,940
1961	96	-	-
1962	2,948	335	-
1963	224	17	275,562
1964	300	13	1,050,711
1965	96	6	791,054
1966	64	3	644,235
1967	1,530	193	1,063,589
1968	289	21	1,373,656
	16,439	1,368	5,296,893

Table 2 Smallpox Cases Detected in Epidemiological Investigations

October 1967 to September 1968

Area	Date of Survey	No. of Cases	Coming from
Forecariah	December 1967	1	-
Kindia	February 1968	15	Sierra Leone
Dabola	" "	26	Sierra Leone
Faranah	" "	16	Sierra Leone
Faranah	March "	1	Sierra Leone
Conakry	" "	1	Sierra Leone
Mamou	May "	36	Sierra Leone
Fria	June "	20	-
Boffa	September "	20	-
Forecariah	July "	2	Sierra Leone
Conakry	August "	1	Sierra Leone

Difficulties in Determining the Source of Smallpox Outbreaks and in Conducting the Vaccination Programme

Our domestic organization, as described, facilitates early case finding of smallpox. At every level, information is communicated speedily from the base (family, village Committee) to the apex (Ministry of Social Affairs), by way of the local arrondissement and administrative area health authorities. Through health, civic and political education, our people understand the seriousness of smallpox, its fatal nature and contagiousness. For example, the village of Kalela, Banko, spontaneously organized isolation procedures when an outbreak of 26 cases of smallpox with seven deaths occurred. Additionally, our people understand the need to report to the local Committee on the state of health of any indigenous or foreign person arriving from a neighbouring country.

Despite this vigilance maintained by public participation, we sometimes have difficulty in determining the origin of smallpox outbreaks and in achieving good vaccination coverage. The principle reasons are as follows:

(1) Clandestine movements across frontiers

Some itinerant traders and families living in areas adjoining neighbouring countries, instead of following the usual international routes which are manned by a frontier post nurse, prefer to use the thousands of unsupervisable frontier paths in order to avoid customs and Security Service formalities and measures. It is difficult if not impossible to obtain epidemiological information about this type of traveller. This situation could be improved by strengthening frontier control by the Security Service, the local health authorities and the people of frontier villages.

(2) Absenteeism during general or selective vaccination operations

Under a number of circumstances, groups of people are missed during the vaccination programme.

(a) Travellers

(b) Agricultural workers, especially when vaccination programmes are conducted at crucial stages in the agricultural year or during herdsmens' transhumance.

(c) Entire villages may be missed when the assembly point is some distance away and the road infrastructure is poor. For example, two small villages, Haffia and Amaraya, in Sougueta Arrondissement, did not attend the vaccination centre and subsequently had an outbreak of 15 cases, in February 1968.

(d) Lastly, people who deliberately and without good reason avoid mass vaccinations.

Certain steps can be taken to ensure better vaccination coverage. The peasant's calendar should, of course, be taken into account when programmes are drawn up. A small frontier control surveillance vaccination team may be organized by the Security Service, the local health authorities and the inhabitants of frontier villages to pick up laggards, a day or two after the main team has left. A vaccinator or a small vaccination team may be sent to remote Committees where access by vehicle is impossible. Joint vaccination programmes can be carried out on adjacent sides of the borders with neighbouring countries. Finally, and probably most important, is improved health propoganda and political-administrative co-ordination.

(3) The consequences of ignorance, sentimentalism and mistrust

Sometimes, the population remains unaware of the severity of the disease, with the result that hygienic and preventive measures in regard to an infectious person are not taken. Parents and friends frequently, out of affection for the infected person, manage to conceal him from the health authorities and take no precautions in the form of isolation measures. Some healers lead patients and their relations astray in order to profit from their credulity. Finally, in a few areas certain cult practices persist which involve seasonal initiation camps at which epidemic outbreaks occur which, if notified at all, are frequently not notified until very late.

Intensified health education, especially where there are gatherings of people, as well as a higher level of literacy should counter these problems. In addition, where smallpox endemity is high, especially in frontier regions, the confidence of the people may be won by a qualified health official who lives in the village or groups of villages for a month or more after the teams have left;

(4) Selective vaccination confined to a village in which one or more cases have been found

Rather than to vaccinate in a single village where cases have occurred, vaccination should be extended to neighbouring villages for preventive action to be successful.

(5) Immediate protection of vaccination site

While engaged in case finding operations and in giving mass vaccinations, we found that vaccinated people sometimes washed the site with soft soap, or applied lemon juice or plant sap thus neutralizing the vaccination and stopping the local reaction.

When we became aware of the practice, we kept the vaccinated people in the shade near where we were working for fifteen to twenty minutes until the vaccine had had time to dry, before sending them away.

(6) Vaccination card

To obtain better coverage, all countries might be asked to make the vaccination card an official document in their territory, the production of which could be demanded at any time by the administrative authorities and the Security Service.

Usefulness of determining the origin of smallpox outbreaks

Of smallpox foci investigated between October 1967 and September 1968 in the Republic of Guinea, most originated from an outside focus, Sierra Leone (Table 2). The other foci certainly did not arise as isolated cases but there was not sufficient information to trace their origin. We believe that there is no such thing as a spontaneous outbreak of smallpox and that every outbreak can be traced to direct contact between infected and healthy persons moving from hut to hut, village to village, and country to country.

It is necessary, indeed essential, to do everything possible to determine the origin of smallpox outbreaks in order to enable the local medical, administrative and political authorities of the countries concerned to take immediately the necessary control measures. These include the early detection of new cases, their isolation and treatment and the vaccination of contacts, the patient's village and neighbouring villages.

Conclusion

My delegation believes that, if the measures recommended are adopted, and methods of investigation are employed that can determine the source of epidemic outbreaks at an early stage, we shall undoubtedly secure the final eradication of smallpox in record time.

RESULTS OF INVESTIGATION AND CONTROL PROGRAMME IN SIERRA LEONE

E. Cummings[1], D. R. Hopkins[2], J. N. Thornton[3]

Over the past quarter century, Sierra Leone has experienced three major smallpox outbreaks at 10 year intervals. The most recent outbreak began in October, 1966. In 1967, Sierra Leone experienced the highest incidence of smallpox of all countries reporting to WHO.

In late January 1968, the Smallpox Eradication Programme began systematically to vaccinate the country's population. By the end of August 1968, 728,190 smallpox vaccinations had been administered in 4 of the 13 administrative districts, affecting 30% of the national population.

In August 1968, the intensified investigation and control effort-termed "Eradication Escalation"-was begun in an attempt to eradicate smallpox even before the mass vaccination phase could completely cover the country. This approach, as applied to the entire 19 country project, was based on the expected coincidence of the usual seasonal decline in smallpox from August to November, and the already significant decline in smallpox incidence presumed to be a result of vaccination of 50% of the target population in West Africa since January 1967. We felt justified in making this extra effort in Sierra Leone partly because the vaccination teams had already vaccinated most of Kono and Koinadugu Districts, perennially the two areas of highest endemicity and highest population turnover, and partly because all of the Guinean side of the common border had by then been vaccinated by the Guinean programme.

The intensified investigation and control programme began with a Special Issue of The Eradicator, the monthly newsletter of the Sierra Leonean Programme. This issue was sent to all dispensers, health inspectors, medical officers, district administrative officials, paramount chiefs and Peace Corps volunteers. It explained the rationale of the effort and appealed to them to be especially alert for smallpox in their areas. This was followed up by personal visits by headquarters staff to District Officers and District Medical Officers in key districts. The District Officers, in turn, also sent circular letters directly to all paramount chiefs under their control. Radio and newspaper appeals were also made.

A four man "fire-fighting team" undertook to investigate and control outbreaks which averaged three per month. SMP headquarters personnel also investigated these and other outbreaks before, with, or after the fire-fighting team. In February 1969, the fire-fighting team actively searched 2 of 3 suspect coastal districts looking for smallpox.

Investigation was mainly limited to determining the source of the outbreak and geographical extent of the exposed population. We were able to ascertain the source of approximately three-fourths of the investigated outbreaks. During the first several months of the intensified campaign, determination of the source of an outbreak often led to other previously unknown outbreaks, but recently, most outbreaks have been traced to previously discovered infected areas. In Sierra Leone, widely attended funeral ceremonies for prominent smallpox victims in rural areas are often the cause of wide-spread smallpox outbreaks. The difficulties of tracing all persons in attendance at these funerals or even all villages represented, are obvious.

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[2]Medical Officer Advisor, NCDC/USAID, Freetown, Sierra Leone

[3]Operations Officer Advisor, NCDC/USAID, Freetown, Sierra Leone

Emphasis was placed on the control of each discovered outbreak. This was achieved mainly by vaccination of the entire index village and exposed surrounding villages, and by isolation of victims. A salient feature here was the importance of at least two vaccination visits for each infected village, preferably in late afternoon or evening or very early morning in order to ensure effective coverage of the population. In one district, control of a very extensive outbreak was only attained after we arranged for a vaccinator to sleep in each infected village, thereby being available to vaccinate farmers returning from work in the evening, or before they went out again in the morning. Also important was the occasional separation of the fire-fighting team members into two or even one-man units in controlling wide-spread outbreaks.

Since the beginning of the intensified investigation and control programme there has been a continuous decline of smallpox. This decline is seen in the number of cases, number of outbreaks, and number of chiefdoms infected by month. A total of 10 outbreaks were reported or discovered in 1969. All of the 1969 outbreaks occurred in 5 coastal districts which were unvaccinated. Two of these districts have since been vaccinated, and a third will be completed this month (May). There were six new outbreaks discovered or reported in January this year, three in February, one in March, and none in April.

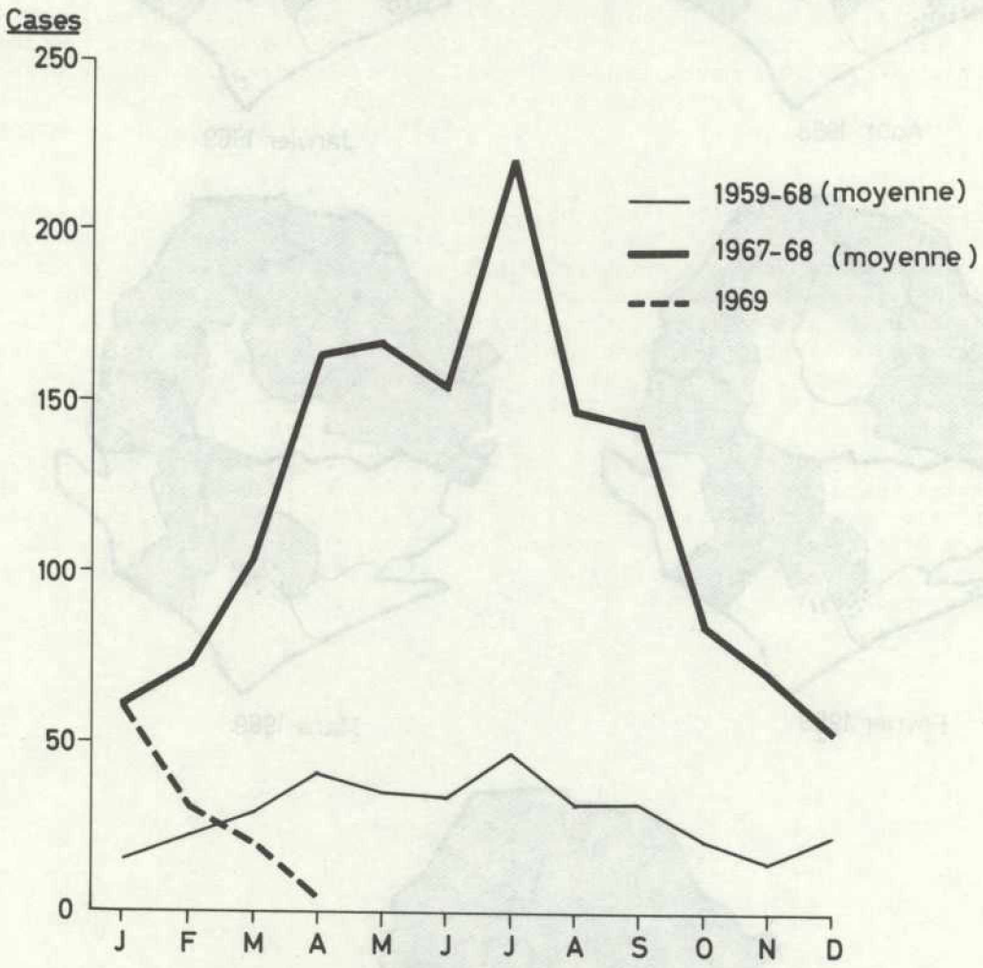
Especially significant is the fact that, while smallpox reports in the last 4 months of 1968 were only about 30% less than in the same period in 1967, there has been in the first four months of 1969 a steady decline in smallpox cases - with only one case with onset in April - even though smallpox incidence normally increases in Sierra Leone at this time of year (Figure 1). A total of 114 cases were reported or discovered in January, February, March and April 1969. In 1968, 112 cases were officially notified in January alone. Reduction in the geographical extent of the disease is seen to have been achieved at an equally rapid pace (Figure 2).

We have of course had instances of delays and failures in reporting, and of inadequate control measures taken after we did learn of some outbreaks. But in summary, we feel that the effectiveness of this type of intensified investigation and control programme, in conjunction with an efficient mass vaccination effort, has been especially dramatic.

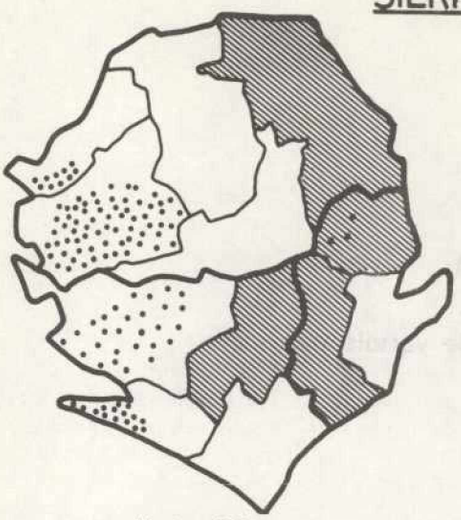
The statistics speak for themselves.

Figure 1

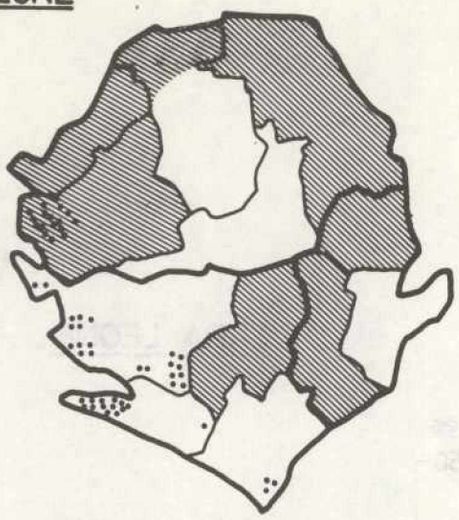
SIERRA LEONE : Cas de variole par mois



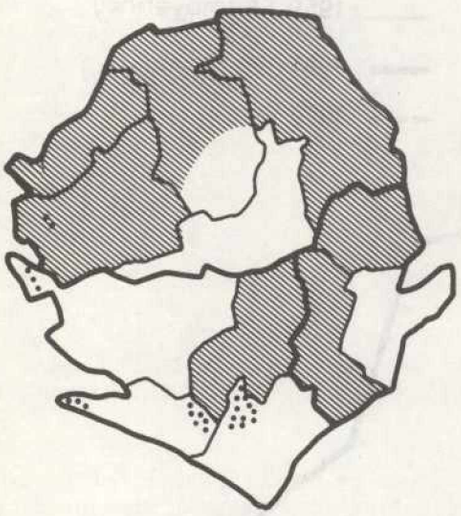
SIERRA LEONE



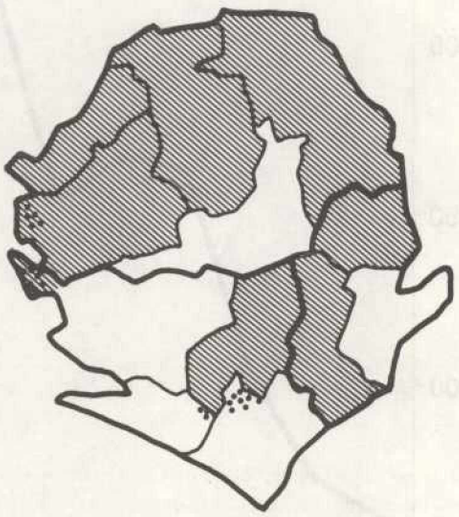
Août 1968



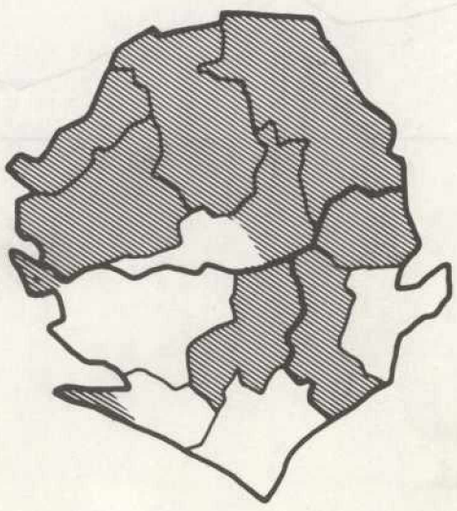
Janvier 1969



Février 1969



Mars 1969



Avril 1969

Un cas de variole

Régions vaccinées

USE OF HOUSE-TO-HOUSE SURVEYS IN FINDING SMALLPOX CASES

A. N. Agle[1]

Early in the autumn of 1968, a letter was sent from the National Communicable Disease Center to 9 countries of West Africa where smallpox was endemic suggesting methods by which smallpox transmission might be rapidly halted. The approach which was outlined has come to be referred to as "Eradication Escalation".

At early planning meetings for the Eradication Escalation activities, the first conclusion reached was that we, in Togo, did not have enough personnel to carry out such a programme. We were about to enter the dry season after a long and very wet rainy season which had entirely interrupted the mass campaign and put it considerably behind schedule. Wishing to take advantage of the dry season for mass campaign activties and to avoid additional set-backs in the campaign schedule we could hardly afford to use any of the personnel from our vaccination teams for fire-fighting or active surveillance work. Our three vaccination teams consist of a total of only 12 people.

If we were to carry out Eradication Escalation activities effectively, we knew, we would first have to extend and reinforce our surveillance network. In fact, actions had already been taken to do just that, and we actually found ourselves in the uncomfortable position of having created enthusiasm among the many people recruited to look for and to report cases while being without the means to provide an immediate response to their reports. In other words, we had succeeded in extending and reinforcing only half of the surveillance programme, that of reporting. Should we be unable to respond to case reports with fire fighting teams we felt that enthusiasm among the volunteer reporters would soon decline.

This argument was used to reinforce our request for additional personnel. For active surveillance as well as fire-fighting activities, we also felt that it would be in our interest to have personnel who were directly under our control and who could report regularly whether or not cases of smallpox were occurring in their areas. Two separate and unrelated events occurred, however, which enabled us to have, temporarily, the additional people we needed.

First a large smallpox epidemic developed in September in Anecho Health Sub-Division. This Sub-Division is in the southeast corner of Togo and is a densely populated agricultural area with about 175 persons per square kilometre. It is also the pilot area of the WHO Basic Health Services Project and the demonstration zone of the Malaria Programme. Anecho has a group of some 15 itinerant health workers assigned to the Basic Health Services Project, whose job it is to visit every village, hamlet and farm in their respective districts once a month. Because of the gravity of the smallpox epidemic they were put at our disposal.

These health workers were trained in multiple puncture vaccination with the bifurcated needle and were directed to carry out a systematic house-to-house vaccination programme. I might add, parenthetically, that Anecho had been vaccinated during the mass campaign, but for several reasons, primarily the coincidence of annual tax collection with the campaign and resistance of some people to vaccination, the coverage was less than 50%. (The overall vaccination scar rate was, however, much higher).

During the months of October, November and December 1968, the months when the itinerant health workers were carrying out their vaccinations, 89 cases of smallpox were detected in Anecho. All 89 were found by these men either during the house-to-house vaccination programme or in case investigation.

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During the next month, October, we were informed that spraying activities carried out by the malaria programme were temporarily interrupted and that we could employ these personnel for smallpox work until the end of December. With the additional personnel, we were able to (a) increase the size of our regular mobile teams, (b) establish an assessment team with bicycles purchased from the Ministry of Health smallpox budget, (c) field 8 teams of 6 people each to carry out house-to-house vaccinations and smallpox search and (d) establish one highly mobile fire-fighting team. We were also given the whole of the malaria programme supervisory staff to supervise and to co-ordinate activities.

Their activities were many. Teams were put into areas reporting smallpox to vaccinate the surrounding area after the immediate contacts had been vaccinated by the fire-fighting team. Teams on bicycles conducted mass campaigns in one Circumscription, a mop-up campaign in another, and active surveillance and maintenance vaccination in the rural areas of Lome.

Everywhere they worked, they went from door-to-door and looked for smallpox. During October, November and December they performed over 75,000 smallpox vaccinations. Perhaps more important, however, the temporary staff found three-fourths of the total reported smallpox cases. In December, for example, they found 80 of the 84 total cases during the month.

Although we were originally told that we could employ the malaria staff only through the end of December, they were in fact with us until mid-February. From October 1 until their various dates of return to their regular activities the temporary staff vaccinated 352,363 people including 40,866 primary vaccinees. In carrying out the house-to-house search for smallpox, they found 226 cases, slightly over 80% of the total during the period.

I would, however, offer a word of caution to anyone who may contemplate using a system involving house-to-house visits. Close supervision is required. In Anecho, supervision was not adequate and in April of this year, we suffered the consequences- an outbreak of 45 cases, including 8 deaths. These cases were found by the supervisor of the itinerant health worker who was responsible for vaccinating the area concerned. The supervisor heard a rumour that smallpox was present in this area. He himself found the cases, having been unable to locate the itinerant agent whom he had not seen for two months. Apparently, this was a unique situation; surrounding areas appeared to have been better vaccinated. The epidemic is believed to have been stopped by the rapid and responsive action taken by this supervisor. No cases have been found with an onset date later than April 10, although it was only a week earlier that the first case was discovered.

We have seen in Togo that, provided there is adequate supervision, one can make good use of temporary and auxiliary personnel in smallpox surveillance. The value of a house-to-house search for smallpox in suspect areas seems obvious. Had it not been for this particular approach, Togo would not have recorded a record number of smallpox cases in 1968 and, in fact, we would have noted a marked decline in reported cases during the final quarter of 1968. Of the 207 cases reported only 34 were detected by the normal surveillance network.

Having noted the lack of sensitivity of the normal surveillance network, we somehow sleep better at night when we know that someone will be out tomorrow, knocking on doors, looking for that last case of smallpox.

PERSISTENCE OF SMALLPOX IN REMOTE UNVACCINATED VILLAGES

P. Imperato[1], O. Sow[2], M. LaPointe[3], D. Vastine[4], T. Leonard[5]

INTRODUCTION

On October 31, 1968, the Ministry of Health, Upper Volta, was informed of a smallpox epidemic along the Mali-Upper Volta frontier. An investigation of this epidemic revealed that it had occurred in Upper Volta in a small mountain village, Cani, situated along the frontier. A total of 40 cases of smallpox had occurred in Cani between May 1968 and the time of the investigation. The index case in this outbreak came from a village in Mali, Kouna, some 15 kilometres away, atop the same mountain chain.

Smallpox vaccinations were performed in Cani and in several other villages on the Upper Volta side of the frontier on October 11.

On November 6, the Smallpox Measles Programme, (SMP), Upper Volta telegraphed the SMP Mali the results of their field investigations. On the same day, SMP Mali replied and proposed a joint search for smallpox on the Mali side of the frontier by both Malian and Upper Voltan health authorities. Over the next week the details for this joint undertaking were worked out, final plans being made by telephone between Bamako and Ouagadougou on November 11.

PLAN OF ACTION

The mutually agreed upon plan called for: (1) a joint meeting between Upper Voltan and Malian Grandes Endemies authorities and the respective SMP personnel of USAID-NCDC. The town of Tominian, in Mali, was chosen as the meeting place. (2) a joint search on the Malian side of the frontier for smallpox was to be undertaken in the area of Kouna and (3) epidemic control measures were to be implemented on both sides of the frontier.

HISTORICAL CONSIDERATIONS

The village of Kouna lies in the arrondissement of Koula; on March 4, 1968, seven months before the last outbreak a telegram-letter had been received at the Ministry of Health in Bamako from the Commandant de Cercle, Tominian, reporting six cases of smallpox in the village of Koula. Epidemiologic investigations carried out on March 6 and March 25 revealed a total of 12 cases of smallpox in the village of Koula and 28 in the village of Berekan, 12 kilometres to the northwest. While these villages had been vaccinated in November, 1967, by the mass vaccination teams, the investigations revealed that many of the children had avoided being vaccinated. As a result, most of the cases occurred in the pediatric age group.

Two vaccination teams were sent to this area on March 6 in order to control the outbreaks. In Berekan 290 vaccinations were performed and, in Koula, 210 vaccinations.

At the time of the investigation of the Koula outbreak, it was learned that there was a village, Kouna, some 28 kilometres to the north of Koula, where smallpox cases had been seen. This village was at the time inaccessible except on foot and the inhabitants of Kouna had been asked to go for vaccination to an assembly point 10 kilometres away (Lanfera).

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[2]Chief Medical Officer, Socio-Preventive, Bamako, Mali
[3]Operations Officer Advisor, NCDC/USAID, Bamako, Mali
[4]Medical Officer, Smallpox Eradication Programme, NCDC, Atlanta, Georgia, USA
[5]Operations Officer Advisor, NCDC/USAID, Ouagadougou, Upper Volta

FRONTIER CO-ORDINATION MEETING AT TOMINIAN

On November 13 the Malian team arrived in the town of Tominian. The Upper Volta team arrived late the same night. Discussions were held that night about the current status of smallpox on both sides of the frontier. It was mutually agreed to travel to Kouna on the following day in order to search for possible smallpox.

TRIP TO KOUNA

The following morning a meeting was held with the Commandant of the Cercle of Tominian in order to familiarize him with the purpose of the joint search and control mission. It was decided to approach Kouna from the Upper Volta side of the frontier. Both teams crossed over into Upper Volta early that day and spent most of the day searching for an approach to Kouna. The presence of a village with the same name on the Upper Volta side added to the confusion. Conflicting advice was obtained in most villages about how one could get to Kouna. Finally it was learned that Kouna lay 10 kilometres by footpath on the other side of a chain of rocky mountains. That afternoon the village of Cani was visited and one additional case of smallpox was uncovered. The following morning the investigation team comprised of 36 people set off single file across the mountains on foot.

THE VILLAGE OF KOUNA

The village of Kouna is divided into eight separate units, each separated from the other by a distance of about one-half kilometre. Each of these units of "quartiers" were once separate and autonomous villages which, for the purpose of administration, were grouped together as one unit. The population of these quartiers is as follows:

Kouna Marka	364
Kouna Gadala	205
Kouna Habe	288
Kouna Diabo	168
Kouna Sambo	50
Kouna Tomon	106
Kouna Alabo	73
Kouna Ono	109
TOTAL	1,363

There are two ethnic groups living in Kouna, the Dogon (Habe) and the Marka (Dafing). The former live in the quartiers on the mountain tops, the latter in the valley.

Although Kouna is regarded administratively as a single integrated village, in point of fact, each quartier has a traditional authority system.

WORK PLAN IN KOUNA

It was agreed that the main aim of this operation was the vaccination of as many people as possible. Because of a lack of porters, only the most essential supplies were trekked into Kouna - vaccine, jet guns, water, medical supplies, etc. The distance and difficulty of the trek required much more time than the actual operation. Because of these factors, the entire operation had to be accomplished in one day. The chief of Kouna Marka had been told the previous day that the teams would be coming. This quartier is in reality the nucleus of the village complex and the most populated.

The expedition first arrived in Kouna Habe, a semi-abandoned settlement on the top of the mountain ridge, and then made the difficult descent, 1,200 feet, into the valley. Vaccinations were given with the jet injector to all the inhabitants present. The chief was asked to bring everyone out, even those with smallpox. The results of

the vaccinations were tabulated, as well as the number of people with smallpox scars or smallpox and vaccination scars. This operation was carried out in Kouna Marka. There was a market that day, held on the mountain top beside Kouna Habe. Fortunately, this market began at noon, at which time the expedition re-ascended the mountain in order to vaccinate it. Five-hundred and seventeen were vaccinated in the village and 24 in the market.

THE EPIDEMIC

Sixty-five persons who had had smallpox were observed in Kouna, three of whom were in the desquamation phase, the others being healed (Table 1). No attempt was made to determine the date of onset of each case. The epidemic was said to have begun with a ten year old girl who entered Kouna some time in late 1967 with smallpox. This child had previously traveled through adjacent parts of Mali and Upper Volta. The last case occurred in October 1968. The disease spread to all other quartiers, being still present at the time of the investigation in Kouna Gadala.

TABLE 1: CASES OF SMALLPOX IN KOUNA VILLAGE BY AGE AND SEX

Age	Number Examined	Cases of Smallpox Male	Female	Total	Attack Rate %	Percentage Distribution By Age (this outbreak)	Percentage Distribution by Age (Other Mali outbreaks)
0-5 mo.	18	2	0	2	11.0	3.1	2.6
6 mo.-7 yrs.	75	4	0	4	5.0	6.2	34.6
5-14	199	19	11	30	15.0	46.1	55.0
15-44	183	13	14	27	15.0	41.5	7.1
45+	42	1	1	2	5.0	3.1	0.7
TOTAL	517	39	26	65	12.5	100.0	100.0

Overall, 83.7 % of the villagers lacked vaccination scars (Table 2). Of those who had scars, the majority were from scarification vaccinations performed years ago.

TABLE 2: VACCINATION STATUS OF 537 INHABITANTS OF KOUNA VILLAGE

	MALE			FEMALE		
	Vaccination Scar Absent			Vaccination Scar Absent		
Age	Total	Number	Percent	Total	Number	Percent
0-5 mo.	29	29	100.0	37	36	97.3
6 mo.-7 yrs.	61	59	96.7	64	60	93.8
5-14	85	61	71.8	46	35	76.1
15-44	82	61	74.4	65	52	80.0
45+	40	32	88.0	28	25	89.2
TOTAL	297	242	81.5	240	208	86.7

The villagers confirmed that the vaccination team had not entered Kouna in 1967. Rather, word had been sent for the villagers to assemble at Lanfera, a village 10 km away.

ATTACK RATE

Among the 517 people screened in the village, 65 (12.6%) had evidence of smallpox contracted during the present outbreak. Presuming that all or most cases were seen, the attack rate for the village of Kouna as a whole would be 4.8%. However, not all cases were seen nor were the fatal cases taken into account. No estimate of the mortality rate was made since no one could say for certain how many had died during the outbreak.

AGE DISTRIBUTION OF CASES

The age distribution of cases in this epidemic varies greatly from that observed in previous investigated epidemics in Mali. Of the total, 41.5% of cases occurred in the 15-44 age group compared to 7.1% in other Malian epidemics. Only 6.2% of cases occurred in the 6 months to 4 year age group compared to 34.6% in other epidemics.

Most outbreaks in Mali in 1967-68 occurred in areas where a large percentage of the population above 5 years of age had been vaccinated at one time or another. The highest attack rates, therefore, were seen in the pediatric age groups and smallpox in Mali was characterized, as a consequence, as a disease of unvaccinated children. The vaccination status of Kouna differed from other villages with outbreaks. In this village, remote and inaccessible except by foot, 83.7% of the population was unvaccinated. In no instance was more than 30% of any given age group found to have vaccination scars. The highest percentage of unvaccinated individuals was in the less than five year age group.

Thus, one might expect the outbreak in Kouna to involve all age groups, as, in fact, it did. Although the variation in rates by age might be accounted for by the small numbers involved, one would have expected a higher attack rate in the 6 month to 4 year age group. Possible reasons for the lower rate are (1) parental failure to bring children who had smallpox to the vaccination site; (2) a high mortality rate in this group, (3) a substantial number in this group without visible scars of smallpox.

DISCUSSION

The outbreak of smallpox in Kouna, its natural history and the manner in which it was handled illustrates most of the issues which are crucial to the chances of successful eradication of smallpox in this part of Africa.

(1) Pocket of Susceptibles in Previously Vaccinated Area:

Kouna was, until it was vaccinated on November 15, an isolated susceptible population. This was the result of its geographic inaccessibility. When vaccination was carried out in November 1967 in the cercle of Tominian, in which Kouna lies this village was not vaccinated. For want of a better expression, Kouna was the victim of the use of "Assembly points for Vaccination". From the vaccination scar data, it is obvious that most people in Kouna did not go to the assembly point 10 kilometres away. For this they cannot be condemned. The time (an entire day), effort, and physical stamina required for walking from Kouna to the assembly point at Lanfera and for transporting a family there by foot for the purpose of a vaccination would have been considered too great, even if all of Kouna's inhabitants had been directly threatened by smallpox.

The use of assembly points of this nature in the mass vaccination programme was prohibited during the 1967-68 campaign. This decision was made because extensive experience with smallpox outbreaks in sedentary populations had shown, time and time again, that widely spaced assembly points left susceptible populations among whom smallpox invariably appeared. The fact that the people of Kouna were asked to assemble at Lanfera represented a violation of instructions on the part of the team concerned.

(2) Rate of Transmission

As has been shown many times before, smallpox in Mali is a disease which, while infectious, is not highly contagious. The disease in Kouna showed itself to be a "silent smoulderer". In brief, smallpox smouldered for almost a year in a village of 1,363 people, 83.7% of whom were unvaccinated.

(3) Local Attitudes Toward Smallpox

The Marka in Kouna are Moslem and attributed the epidemic to God. The cases were not isolated and the disease was not viewed by the village as a whole as a great threat. In brief, the slow rate of transmission, the presumed low mortality and the mild nature of the disease (most cases had had mild benign discrete rashes), engendered a casual attitude towards smallpox in Kouna.

ASSOCIATED WITH EXPOSURE AT A FUNERAL CEREMONY:

SMALLPOX OUTBREAK - YAWEI CHIEFDOM

KAILAHUN DISTRICT, SIERRA LEONE

E. Cummings[1], D. R. Hopkins[2], J. N. Thornton[3]

BACKGROUND

An outbreak of smallpox occurred in Yawei Chiefdom, Kailahun District, Sierra Leone, in May 1968.

Kailahun District is bordered on the east by the countries of Guinea, and Liberia, and on the west by Kono and Kenema Districts in Sierra Leone. Approximately 162,615 people reside in the District which has a population density of 97.0 persons per square mile. An international market is situated at Koindu, near the point where the three countries meet. The district has a comparatively extensive laterite road network, two hospitals, two health centres, three mission dispensaries, and fifteen treatment centres, and consistently, the lowest incidence of smallpox in Sierra Leone.

THE EPIDEMIC

Smallpox cases in the Yawei outbreak were first reported in late May, 1968, to a local health inspector who immediately sought out and isolated the patients and conducted "ring" vaccinations among individuals in close contact with these patients. On June 8, the Sierra Leone Smallpox Eradication/Measles Control Programme received word of the outbreak and subsequently despatched a vaccination team which administered 3,421 vaccinations in the Chiefdom on June 14 and 15.

EPIDEMIOLOGICAL INVESTIGATION

The index case for the epidemic was a 40-year old female petty trader who visited the village of Wordu, in Kono District, sometime in late April. She was there only overnight. Approximately one week after her return to the village of Kavuyama, she complained of headache, fever and neck pain, five days later she developed a rash; two days after that, she died. Her illness was not recognized as smallpox at that time.

The woman was also local head of the Bundu (Sande) Society, a secret female society. Several visitors came to see her during her illness. Women from throughout the chiefdom and beyond attended her funeral. In all, an estimated 243 persons attended her funeral (110 persons from the village of Kavuyama, 130 from other towns in Yawei Chiefdom, 3 persons from adjacent Sandaru Penquia Chiefdom). A listing of the cases, describing those individuals who developed smallpox after contact with the index patient, is given in Table 1.

A peculiar pattern of exposure and transmission resulted from the index patient's position as head of the female secret society.

Ninety percent of the secondary cases occurred in persons over 30 years of age, and 70% of the secondary cases were women over 30 years. Of the ten secondary cases, seven were individuals who had been vaccinated, but more than five years previously; all these seven patients recovered. The three other secondary cases had never been vaccinated, and one of those died. Furthermore, the individuals most exposed to the index case were generally over 15 years of age.

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In a scar survey (Table 2) which was conducted on June 12, it was observed that 73% of the over 15 years age group showed old vaccination scars, indicating that a significant amount of protection existed among this group. This would partly account for the limited extent of the smallpox transmission in the epidemic.

Three types of exposure to the index patient were identified as apparently responsible for the transmission of smallpox in the epidemic: (1) visit to the index patient during her illness; (2) washing of the corpse. (3) attendance at the funeral. With the exception of the seventh patient, all the secondary victims experienced at least two of these kinds of exposure. Four of the patients experienced all three types of exposure. Case 7, the only case with a single exposure, was unvaccinated. Of the six persons who washed the index case's corpse, all six were infected. However, since the interval from washing the corpse to onset of disease in two of these was only 8 days, it is more likely that they were infected while visiting the index case before her death. The attack rates were much lower among those individuals exposed by visiting the ill woman, or by attending her funeral (10/243, attack rate of 4.1%). The overall case fatality rate was 18.3%.

Case seven had direct contact with the index patient only once, on the day of the funeral. His rash began on May 24. Unless he was infected by virus passively brought home by his mother (who visited the index patient while she was ill), he must have been infected about May 12. Hypothetically, therefore, the index patient's rash began sometime around May 9 or 10.

Although the corpse was kept in the house of case four for 24 hours, it is surprising that there were no other infections in this household. Of the fifteen inhabitants, none had been vaccinated in the past 5 years; seven had never been vaccinated. It is perhaps significant that the body had already been washed, and also was obviously no longer exhaling virus.

CONCLUSION

The fact that the index smallpox patient apparently developed smallpox after an overnight visit in the Kono-Koinadugu area is probably typical of many such episodes in which smallpox is spread by transient visitors or residents to a highly endemic area. Moreover, the importance of intimate contact in spread of the disease is also illustrated.

This outbreak barely hints at the potential for wide-spread dissemination of smallpox as a result of widely attended funeral ceremonies for prominent victims of the disease, often secret society officials. In rural areas of Sierra Leone, this mode of dissemination is frequently implicated as the origin of wide-spread smallpox outbreaks.

Perhaps the most important point about this outbreak, however, is that it illustrates the effectiveness of early isolation of cases and vaccination of immediate contacts.

TABLE 1

SMALLPOX CASES - YAWEI CHIEFDOM

Case No.	Village	Age	Sex	Onset	Vaccinated	Outcome	EXPOSURE: Visited Patient	EXPOSURE: Washed Corpse	EXPOSURE: Attended Funeral
1*	Kavuyama	40	F	mid May?	?	Died	-	-	-
2	Kavuyama	50	M	5/22	No	" 6/7	Yes**	No	Yes
3	Kavuyama	30	M	5/23	No	Recov.	Yes	No	Yes
4	Kavuyama	30	F	5/23	>5 yrs	Recov.	Yes	Yes	Yes
5	Kavuyama	35	F	5/23	>5 yrs	Recov.	Yes	Yes	Yes
6	Kavuyama	45+	F	5/24	< 5 yrs	Recov.	Yes	No	Yes
7	Kpanguima	4	M	5/24	No	Recov.	No	No	Yes
8	Bendu	50+	F	5/26	>5 yrs	Recov.	?	Yes	Yes
9	Malema	45+	F	5/26	>5 yrs	Recov.	Yes	Yes	Yes
10	Malema	60+	F	5/26	>5 yrs	Recov.	Yes	Yes	Yes
11	Bendu	60	F	5/29	>5 yrs	Recov.	No	Yes	Yes

* Index Case

** Husband of case 1

TABLE 2

Vaccination Scar Survey, Yawei Chiefdom

Age	Percent with Vaccination Scar
< 1	0
1-4	17
5-14	57
15-44	75
45+	70

ROLE OF MIGRANT GROUPS IN THE TRANSMISSION OF SMALLPOX IN MALI

O. Sow[1]

The importance of population movements in the case of a communicable disease like smallpox is understood by all. Though strict legislation has solved the problem at the international level, the position is quite different within our countries. The special problem presented by migrant groups, over and above the difficulties in reaching them for vaccination, is the possibility that they may carry the disease from one part of a country to another and from one adjoining country to another, because immunization of these groups is incomplete.

In Mali, migrants constitute a considerable part of the population. Broadly speaking, the Peulhs, Tauregs and Bozos of the Central Niger Delta may be regarded as internal migrants, and the seasonal workers who periodically leave Mali for Niger, Ivory Coast, Ghana, etc., as emigrants.

The Peulhs' movement is connected with transhumance, a socio-economic phenomenon that has been a characteristic of this population of herdsmen for decades. The transhumance takes the form of an annual movement towards the pasturage along the banks of the Niger or of the Central Delta when the fall in the river's water level permits growth of a particular plant ("bowgou") on which the animals feed. These peoples are thus involved in two great movements between October and June, towards Lake Debo, and from Upper Volta towards the banks of the Ban. In the north of the country, Tauregs and Peulhs also move to the bowgou pastures of Lake Debo. These population movements involve some 100,000 people. Among internal migrants mention should also be made of the Bozo fishermen on the Niger, who move in search of areas of the Central Delta where there are plenty of fish.

As to the seasonal workers, economic circumstances oblige them to move towards the adjoining countries as soon as the harvest is over. These migrations often involve all the men of some villages in the north.

In addition, there are traders who go from market to market within an economic area. Though they are few in number their mobility often causes them to be missed during vaccination programmes. Thus in 1967 when one market was inspected we found that 70% of the traders had not been vaccinated.

We have then a large category of people who create many problems by their way of living. The scale of the problem, epidemiologically, may be seen from a breakdown of smallpox cases in the last two years.

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Outbreaks Definitely Traced to Migrants

	Outbreak No.	No. of Cases	Comment
1967	1	15	First case was a Peulh
	2	66	Transhumance area-first case was in a Poulh
	3	145	First case was a migrant from Niger
	4	9	
1968	1	21	First case was a Taureg
	2	7	
	3	41	
	4	65	
1969	1	1	
Total	9	370	

These cases represent more than three-fourths of all cases recorded in Mali during this three year period.

To cope with this problem, we need to know the transhumance axes and the assembly points which, by long tradition, have become virtually permanent, and to design programmes which take these factors into account. The possibility of a health care system for seasonal workers should be considered. Inter-frontier coordination of vaccination programmes is also required. When these operational and administrative aspects have been taken into account, the greatest possible allowance must be made for the psychology and mentality of the peoples, particularly the Tauregs and Peulhs. These constantly moving ethnic groups have usually escaped the medical attention of health units. The Peulhs have a religion of their herds and frequently look after their cows better than themselves. They must be sought out where their herds are located and vaccinated there. The fluidity and mobility of a people such as this also make the cooperation of the traditional chiefs necessary.

If this whole complex of factors is taken into account, it may be possible to remove the risk represented by migrants in our eradication programmes.

A STUDY OF SMALLPOX IN THE TUAREGS IN TAHOUA, NIGER

A. R. Masso[1]

INTRODUCTION

The northern arrondissements of Tchin Tabaraden, Bilma, and Agadez in Niger are largely populated by pastoral nomads called Tuaregs. Their estimated population is 150,000. Efforts to vaccinate them have not been very successful. However, since only one case of smallpox has been reported from these arrondissements in the last two and one half years the threat of smallpox has generally been considered minimal. Nomadic populations in other parts of West Africa have been considered to be important sources of smallpox transmission within their own groups and as sources of infection of sedentary populations. This belief has been based largely on the known smallpox transmission by seminomadic Fulani stock-breeders on the Nigeria/Niger and Upper Volta/Niger borders.

The purpose of this study was to determine the potential threat of smallpox in the pastoral Tuareg society.

ETHNIC GROUPS SAMPLED

The ethnic groups studied were Tuareg and Bouzou Nomads in the Arrondissement of Tohin Tabaraden. The age and sex distribution of the 502 persons sampled is shown below.

Table 1: Age and Sex Distribution of Sample of Tuareg and Bouzou Nomads

	M	F	TOTAL
0-11 months	10	16	26
1-4 years	50	46	96
5-14 years	49	46	95
15-44 years	127	102	229
45+	32	24	56
TOTAL	268	234	502

RESULTS

The sample population was examined for vaccination scars, (Table 2), smallpox scars, (Table 3), and variolation scars, (Table 4).

The vaccination scar rate was 38.4% for the population as a whole; scar rates were highest (52.6%) in the 5-14 year age group; the rate was only 35.4% in the 1 to 4 year age group, and 25.0% in persons 45 years old or above. In the adult group the rates in males and females were similar.

Smallpox scars were found in 2.2% of the group. None was found in persons under 5 years of age and the highest rate, in those over 45 years was only 3.5%.

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On the other hand variolation scars were found in 29.0% of persons. The rate was highest in those over 45 years (53.6%) and decreased with decreasing age. The rate was 9.4% in the 1 to 4 year age group; and no variolation scars were seen in children from 0 to 1 year old.

When a smallpox immunity index was calculated, based on the assumption that persons with vaccination scars, smallpox scars, or variolation scars were immune, it was concluded that 67.1% of the population was immune.

Table 2. Vaccination Scar Rates by Age Groups

	No. Sampled	No. with Vaccination scars	% with vaccination scars
0-1	26	1	3.8
1-4	96	34	35.4
5-14	95	50	52.6
15-44	127(M) 102(F)	54(M) 40(F)	42.5(M)39.2(F)
45+	56	14	25.0
Total	502	195	38.4

Table 3. Smallpox scars by Age Groups

	No. Sampled	No. with Scars of Smallpox	% with scars of Smallpox
0-1	26	0	0
1-4	96	0	0
5-14	95	1	1
15-44	127(M) 102(F)	6(M) 2(F)	4.7(M) 1.9(F)
45+	56	2	3.5
Total	502	11	2.2

Table 4. Variolation Scar Rates by Age Groups

	No. Sampled	No. with variolation scars	% Variolated
0-1	26	0	0
1-4	96	9	9.4
5-14	95	18	18.9
15-44	127(M) 102(F)	48(M) 41(F)	37.8(M)40.2(F)
45+	56	30	53.6
Total	502	146	29.0

CONCLUSIONS

Although the Tuareg are a poorly vaccinated group (38.4%), the threat of smallpox is diminished because of an unusually high variolation rate (29%). The very low smallpox scar rate, (2.2% as compared to 5.4% in Niger's sedentary population), in all age groups is evidence that the group sampled has had little smallpox in the past. Furthermore, virtually no smallpox has been reported from this area in two and one half years. This is substantiated by the fact that no scars of smallpox were observed in the 0-4 year age groups.

NOTES ON VARIOLATION

BY

G. F. Glokpor[1]

The Larousse Medical describes "variolation" as:

"An operation giving protection against severe smallpox, employed in earlier times before discovery of the vaccine, and still in use in certain countries (China). It consisted of inoculating in the arm, by means of two superficial punctures, with a solution made by dipping in water the point of a lancet with dried smallpox pus upon it. The results of the inoculation were fairly good; the eruption was usually limited to the arm and the face was saved. A appule appeared on the second day; it pustulated about the fifth day; the pustule umbilicated about the tenth day; a scab formed and left a conspicuous scar. Systematic symptoms such as fever and headache were more or less marked. This mild smallpox gave lasting immunity. But sometimes, instead of mild smallpox, severe smallpox ensued, resulting in death or blindness. Variolation is thus a dangerous method, and is now prohibited."

HISTORY

Variolation is an ancient practice.

Voltaire gives an account of variolation practices in the Circassians in the eleventh of his Philosophical Letters, as follows: "The women of Circassia have from time immemorial been in the habit of giving smallpox to their children, even at six months of age, by making an incision in the arm and inserting into the incision a pustule they have carefully taken from the body of another child. This pustule has the effect, in the arm into which it is introduced, of leaven in a piece of dough and ferments there. The pustules of the child to whom this artificial smallpox has been given are used for transmitting the disease to others....". (Fasquelle, Eléments de virologie médicale) Fasquelle adds that the Chinese too, long before the Circassians, "practised variolation, but by the nasal route with smallpox scabs". Variolation, in fact, was practised in China long before the Christian era.

Interest in variolation in England dates back to 1700-1725, but variolation appeared in popular medical practice in several parts of Europe at least as early as the 1650's. The collection of scabs from smallpox cases for inoculating other people was a common practice in Poland (1671); it was also known in Wales and Scotland and in Naples. The Bedouins appear to have practised variolation for a long time in a number of places in the Middle East and it was from the east that the method was introduced into Europe. It was introduced into England from Turkey at the beginning of the eighteenth century by the wife of the British Ambassador at Constantinople, Lady Mary Wortley Montagu. She had her children inoculated and royal family followed her example. The practice of variolation spread rapidly in England, and it was subsequently practised on a wide scale. The continent of Europe was relatively slow in adopting it. Variolation was observed in Holland in 1749, in Germany in 1750 and in France in 1755. In 1768 an English doctor, Dimsdale, was asked to inoculate the Empress Catherine II of Russia and was rewarded by being made a Baron of the Russian Empire, Councillor of State and Physician to Her Imperial Majesty. Outside Europe the practice was also noted in India and in some parts of Africa.

Thus variolation is a very ancient practice which was extremely widespread and, for a long time, it was the only recourse mankind had against the scourge which struck, at intervals, again and again.

[1]Chef, Division de l'Epidémiologie, Ministère de la Santé, Lome, Togo.

VARIOLATION ON THE BENIN COAST

Although prohibited, variolation is still occasionally practised in some parts of Africa and in our country in particular.

About Ghana, D. Scott writes ("Endemic disease in Ghana 1901-1960"): "In the early days the illegal practice of smallpox inoculation was discovered from time to time, particularly among the Hausa people; it is uncertain how extensive this was or what its influence may have been, but it can be presumed that it resulted in both spread of the disease and increased mortality. In the Accra epidemic of 1920 a fetish woman had induced a number of people to accept inoculation with material obtained from the pustules of cases and in this instance there was a heavy mortality; the inoculation was made on the forehead. More frequently it was carried out on the back of the wrist, and there is a record of another method which was practised in West Africa, the insufflation of dried and powdered material from the desiccated pustules of variolous patients. The most recent discovery of inoculation being carried out in Ghana was in 1930. In that year, when the disease was introduced into the Yendi area of the Northern Region it was found that two Mallams were carrying out arm-to-arm inoculation in the district, and before the epidemic was over some 600 cases of smallpox had occurred with 44 deaths; the inference being that their activities had made a considerable contribution to the size of the outbreak."

In Dahomey, Challenor and Agle discovered a case of variolation in the Ouidah area in 1967, the victim of which died shortly afterwards of severe smallpox. There, variolation was performed by scarification on the forehead.

In Togo, three cases of variolation were found in September 1968, on one of the farms constituting the village of Abidje in Akepe Canton (Tsevie District). There, a pulverized scab was inoculated by superficial scarification on the underside of the wrist. On a second visit, we learned that the perpetrator had fled the village and was only coming back at night to sleep there, because he had learned that we had examined and questioned his three victims. Did that mean he knew about the deadly consequences of his practices? It was said that in some areas the person responsible for looking after a variolous patient must, before he takes up his duties, swallow a little alcohol mixed with material taken from smallpox pustules.

R. H. Henderson, in a study of two smallpox outbreaks in rural areas between Ouidah and Allada in the south of Dahomey, gives an interesting account of the way in which variolation was performed:

"Sometime during the third or fourth week, following onset of a case of smallpox, the healer arranges a ceremony to which the whole village is invited, for 'freeing the patien'. We had occasion to investigate two smallpox outbreaks shortly after the ceremony occurred and we noticed each time that the friends of the smallpox cases had a mark on their forehead just at the base of the nose. Questioning the people, we learned that as an integral part of the ceremony, the healer scarifies the forehead of everyone present with a blade and rubs a powder on the scarified part. This powder is made of a mixture of smallpox scabs and herbs. A number of people seen five days after this ceremony had a round 5 x 5 mm lesion which had already formed an eschar scab in all respects similar to a vaccination scab. From a scab taken at Daujobame from a woman of 35 who had been inoculated by the healer, smallpox virus was grown on culture. Thus variolation is, in this part of Dahomey at least, practised by healers."

These instances of variolation that have been discovered show how diverse the methods are. In the Benin area, variolation is chiefly effected by superficial scarification of the forehead or underside of the wrist using material taken from dried pustules or pulverized scabs mixed with herbs of various kinds.

CONSEQUENCES OF VARIOLATION

The variolators usually believed they were inoculating a mild smallpox to secure protection from severe smallpox. Unfortunately the method entails serious dangers both for the victim and for the community. In France, Fasquelle reports that a decision of the French Parliament, modeled on an English act, provided that operations of this kind must only take place outside towns and that inoculated persons must not mix with other folk until six weeks after recovery. But these precautions proved ineffective against the dangers of variolation. That is why the method was ultimately prohibited and generally abandoned.

The consequences of this practice are several:

(1) It involves collecting and keeping scabs taken from a smallpox infected patient. The scabs retain the smallpox virus for long periods and may subsequently serve to infect people living in or near the inoculator's house. The consequences of reducing the scabs to a powder which can be blown about by the wind may easily be imagined.

(2) The inoculated person can develop severe smallpox and die or be left with severe sequelae such as blindness. The inoculated case in Dahomey died of severe smallpox a few days after discovery.

(3) Variolation is a danger to the community in which the inoculated person lives for he may infect those who come into contact with him. A single inoculated person is enough to initiate an outbreak of smallpox which may engulf an entire village. One wonders whether some of the smallpox epidemics in our villages were not due to variolation, particularly since it is impossible in many cases to trace the source of the epidemic.

ROLE OF LEGISLATION

It is doubtless owing to these harmful consequences of the practice of variolation in certain areas that the WHO Handbook for Smallpox Eradication Programmes (1967) says: "It is vital that every effort be made to terminate present practices of variolation by whatever means necessary, including direct punitive action".

Although efforts have been made in the past in other countries to limit the consequences of variolation by various measures, as in France and England, these precautions proved ineffective and variolation itself was therefore eventually prohibited. In Africa too, in the countries where variolation still occurs and constitutes a danger, the advisability of prohibiting it should be considered.

But I do not think that simply passing a law is enough to abolish the practice overnight. Variolation is usually, in Togo and Dahomey, an occult practice. It occurs in initiates to a secret society at the end of the period of initiation, and it is practised in healer's "surgeries" on the patient's relations and friends. Only in exceptional cases is it medicinal. Consequently it is no easy matter even to detect it. Education of the public would therefore be a help. Maybe in the near future, with the eradication of smallpox, variolation will disappear of its own accord for lack of smallpox scabs.

THE ROLE OF FETISH PRACTICES IN VACCINATION CAMPAIGNS

G. E. Robbins[1]

The Smallpox Measles Programme has met with enthusiastic acceptance in most countries, but in two of them, Dahomey and Togo, it became increasingly apparent that potentially serious problems were being encountered. Reports were received of entire villages fleeing from vaccination teams and their white trucks. There were also accounts of fetishers actively opposing the programme and frustrating efforts to achieve control of the disease. More disturbing, particularly by mid-1968, were reports of recurring smallpox in previously vaccinated areas in both Togo and Dahomey, particularly the known fetish area.

A study was undertaken to determine whether indeed, there was actual resistance to smallpox vaccination, what role the "fetish" played in it, and what could be done to overcome it.

The study began in January 1969 in Togo and continued for nearly three months in both Togo and Dahomey. Interviews were conducted with a variety of individuals, including government officials, fetishers, village chiefs, and villagers. Extensive field visits were made to observe evidence of fetish practices and conduct scar surveys. Programme records were reviewed and the literature was researched to obtain background on Dahomean and Togolese cultures and specifically those parts relating to religious beliefs and fetish practices.

One of the most significant aims of the entire investigation was to determine if the target population in a known fetish area resists or is opposed to smallpox vaccination. Be Town, a suburb of Lome, Togo, was selected by programme personnel because of difficulties with the mass programme there in September 1967 and smallpox had subsequently recurred there despite the vaccination campaign. Vaccine consumption and tally figures indicated a low vaccination coverage, so a mop-up programme to increase overall coverage was conducted in Be in November and December 1968 using multiple puncture vaccination teams. Within this community it was possible to make a comparison between a known "fetish" area and an adjacent one considered a "non-fetish" area.

A sample of 200 individuals over 15 years of age was selected, half of whom lived in the fetish area, and half of whom lived in the non-fetish area of low vaccination resistance. An interview schedule was prepared to determine the age, sex, tribe, and smallpox disease and vaccination histories of each person. The interview also contained questions concerning attitudes towards smallpox; the degree to which the purpose of the mass vaccination programme had been communicated; beliefs about the causes, treatment and prevention of smallpox; willingness to be vaccinated; and the degree to which vaccination was understood as a health measure.

The coverage in the ped-o-jet vaccination programme was 56% for the respondants from the fetish area and 72% for the non-fetish group. The subsequent multiple puncture programme increased the vaccination coverage in the fetish group to 76% and in the non-fetish area to 83%. In addition, other individuals had been vaccinated within the past three years, so that a total of 88% of the sample from both the fetish and non-fetish areas were found to have been vaccinated within that period of time. If either the presence of a scar or history of vaccination was considered, the total vaccination coverage was exceedingly high: 96% for the fetish area and 99% for the non-fetish sample. Little evidence of resistance to smallpox vaccination exists in this fetish area. In fact, it appears to be absent.

The composition of the population of both areas was strikingly different. Whereas the population of the fetish area for the most part were Ewe (76%) and were descendants of the original settlers of Lome, the non-fetish population was fairly evenly distributed among four tribal groups (Ewe, Mina, Ouatchi and Fon). The fetish area residents tended to be more isolated and have less contact with outsiders than their

[1]Health Education Advisor, NCDC/USAID, Regional Office, Lagos, Nigeria

non-fetish neighbours. The latter tended to be employed in the city of Lome, where they were brought into contact with new ideas and a variety of people. This supports the contention that any isolated group of people will resist more strongly new or innovative ideas or procedures than a group with continuous exposure to new ideas and new people.

Smallpox was recognized to be contagious although people in the sample had little idea how the disease is passed from one person to another. Approximately three fourths of the respondants knew that smallpox cases must be avoided because of the possibility of "catching" the disease.

A high degree of awareness of accepted medical practice was evident in both the fetish and non-fetish area, since virtually everyone sampled felt that a dispensary, medical doctor or vaccination had a role in preventing smallpox. Nevertheless as the herbalist is held in high regard too many of the respondants stated they would seek help from him if no satisfaction was obtained from a medical doctor. Over half the respondants believed that herbalists have preparations which can prevent smallpox. Furthermore, the study showed that people will present themselves for smallpox vaccination without having any idea what the vaccination is for, or what protection it provides.

People will accept smallpox vaccinations regardless of fetish beliefs. Virtually everyone in the sample surveyed, in both fetish and non-fetish areas, attributed smallpox to supernatural causes. Most often mentioned were the fetish, whistling at night, the hot sun and the weather. Few people believed, however, that a fetisher could cause people to become ill with smallpox, and even fewer felt that such a person could prevent smallpox. Because of the extremely high smallpox vaccination coverage in the smaple surveyed it is apparent that the influence of the fetish and the fetisher is, at the present time, limited. This is further underscored by the fact that although no Sakpate (smallpox) fetishers were sampled in Be itself, there is evidence from other areas that the priests and their families have been vaccinated and continued to present themselves for smallpox vaccination. Similar investigation in the Dahomean bush showed that villages with a high degree of fetish beliefs had high vaccination coverage in the adult population. On the other hand, villages with little evidence of fetish practice showed poor vaccination coverage. Any resistance to vaccination appears to be due to insufficient health education and advance preparation of the villagers coupled with a suspicion of strangers rather than anything to do with fetish beliefs.

Some individuals felt that vaccination causes malaria, rheumatism, or even smallpox itself.

Information and education efforts have not been entirely successful in Be. Just slightly over half (57%) of the respondants were aware of the Smallpox Measles Programme even though a larger percentage (79.5%) had been vaccinated by programme personnel. Of those who indicated an awareness of the programme, fully 33.0% had been notified by word of mouth, (friends, children at school, market, dispensary), or simply saw the vaccination teams and were vaccinated (26%). A smaller proportion of individuals (25%) heard of the programme by means of the press or radio. This emphasizes the hazard of publicizing urban vaccination programmes solely by these means. Nevertheless, mass media programmes coupled with subsequent efforts which utilize informal inter-personal channels did reach a considerable proportion of the target population.

CONCLUSIONS

Genuine resistance to smallpox vaccination did and perhaps still does exist a Dahomey and Togo but not, perhaps, for the reasons expected before the study was undertaken. Belief in the fetish and the supernatural is the norm, and is deeply woven into the fabric of the culture of these peoples. It is the only way they have of explaining

the relationship of an individual to his environment and the causes of natural phenomena such as drought, pestilence and epidemics of disease. To say that people avoid vaccination or flee from vaccination teams because of the power of the fetish or the influence of individual fetishers is, unfortunately, a convenient means of explaining programme failures when the real reason is unknown or too difficult to determine accurately. Additional field investigations showed the role of the fetisher in opposing smallpox vaccination to be minimal and a more accurate explanation for vaccination resistance should be stated in terms of the fear of vaccination itself and the suspicion the target population may have of anything new and especially of outsiders.

In West Africa today, a majority of programmes to improve the health and living conditions of the people are carried out through government agencies. Yet in many areas, Dahomey and Togo included, and particularly among the people living in rural areas, suspicion of the motives of government and its representatives is widespread. The demands of taxation, of military conscription and other forms of interference that emanate from the outside have taught the villager that the less he has to do with the government and other outsiders, the better off he will be. In both countries the smallpox "eradicator" is severely handicapped because he is an outsider and, more important, an unknown quantity. A visit to the bush will confirm the fact that a stranger, an unfamiliar vehicle or anything, for that matter, out of the ordinary will be regarded with suspicion.

Reports of villagers fleeing from vaccination teams have come from Sierra Leone, too, where there is no strong fetish belief and where fear of vaccination itself has been found to be the reason.

Meetings with chiefs in a group before a region is vaccinated to explain the programme and vaccination technique with the ped-o-jet has been successful in increasing subsequent vaccination coverage in both Dahomey and Togo.

Approaching villages on an individual basis, meeting with chiefs, village elders, and fetishers and working with recognized leaders appear to be a successful means of overcoming resistance to smallpox vaccination.

There is good evidence in both countries that people will accept vaccination without having an understanding of its benefits and regardless of the degree of belief in the fetish and supernatural. Additional efforts in hard core resistant areas must be aimed at gaining the support and confidence of community leaders to overcome fear of vaccination and to allay the normal suspicions directed at outsiders and anything new. Repeated mop-up programmes in the difficult areas of Togo appear to confirm the strength of this approach.

SUMMARY

J. D. Millar[1]

The preceding papers provide some clarification of issues which have bothered us from the beginning of the programme.

a. Fetishism - it is now quite clear that while this is an interesting phenomenon, worthy of study, it is probably not a significant factor in obstructing the progress of smallpox eradication.

b. Variolation - this well documented, fascinating, and exotic practice is not a serious deterrent to eradication. In all probability the disappearance of smallpox itself will lead naturally to the disappearance of variolation.

c. Purdah - it is of interest that the question of purdah has not even been raised today. Purdah was thought to be of great concern as recently as two years ago, but the coverage rates achieved in Moslem areas of Northern Nigeria and in the rest of the sahael indicate that practices of purdah do not seriously deter mass campaigns.

d. Nomads - the role of the nomad in smallpox transmission is beginning to be clarified. It appears that while nomads represent a poor reservoir for smallpox, (which is expected because of their relatively small numbers, their patterns of moving in small groups, and the minimum population density in areas they occupy), they can for the same reasons be excellent vectors of smallpox transmission when once infected. This is principally due to their remarkable mobility. Several outbreaks have been reported in which migratory people, of one sort or another have introduced smallpox. While nomads must be borne in mind in conducting mass campaigns, and reasonable efforts must be taken to insure high coverage among them, their primary threat is that of transmitting smallpox from one infected sedentary group to one or more other susceptible groups.

A significant portion of today's discussion has centered on the spread of smallpox. While smallpox is obviously not as explosive in its spread as measles or influenza, it appears that the rate of spread can be quite variable. Outbreaks can be indolent or relatively rapid in development depending on the particular combination of source, the type of exposure, and the number of susceptibles in the environment of the patient. If for instance, the source is a highly infective patient with severe smallpox, and there are many susceptibles in intimate contact in the environment, a rapid spread of smallpox will result with a relatively large number of patients in the second generation. On the other hand, if the patient is less infective, the contact more casual and the number of susceptibles limited, the spread of the disease may be slow indeed.

The fact that slow transmission can occur, however, has two serious implications for smallpox eradication in West Africa: (a) chains of transmission of smallpox can continue for long periods without coming to the attention of the appropriate authorities and (b) the capability to spread slowly suggests that unattended outbreaks are not as likely to "burn out" as we had thought. The existence of a slow spread of the disease thus suggests that smallpox can be relatively tenacious.

This makes it imperative to consider outbreak control the ultimate weapon by which to eliminate smallpox. No matter how well a mass campaign may be conducted, gaps in coverage will remain. Slow transmission of smallpox can occur in these small groups. Only by identification and control of such outbreaks can the interruption of smallpox transmission be assured. The epitome of results with this approach can be clearly seen in the aggressive success of the "eradication escalation" campaign carried out in those countries which still had smallpox in September 1968. This campaign, based on

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identification of cases and outbreaks, and their rapid control, has resulted in the elimination of smallpox from all but one area in West Africa. However, its primary method of operation was the active search for smallpox cases.

For the future, the secret of success will devolve upon our ability to improve routine reporting of smallpox cases with resulting rapid outbreak control. Active case detection cannot last forever no matter how successful it is. Routine reporting using the constituted reporting channels, must be improved to a level of sensitivity and efficiency which will permit the identification of all suspected cases and rapid action to contain them.

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